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AUGUST, 1848.

CIVIL ENGINEERING.

The General Railroad Law of the State of New York.

An Act to authorize the formation of Railroad Corporations. [Passed March 27, 1848.]

(Continued from page 13.)

Sec. 21. In case any married woman, infant, idiot or insane person, or any unknown owner, or owners not personally notified to appear, and who shall not appear after such notice on the appointment of commissioners, shall be interested in any such lands, real estate and property, the court shall appoint some proper person to appear before the said commissioners and act as attorney for and in behalf of such married woman, infant, idiot, insane person, unknown owner or non-appearing owner, not personally served with notice.

Sec. 22. If at any time after the location of the track of said road, in whole or in part, and the filing of the map thereof, it shall appear to the directors of the said company, that the line in some parts thereof may be improved, it shall be lawful for the said directors from time to time to alter the line, and cause a new map to be filed in the office where the map shewing the first location is or shall be filed, and may thereupon proceed to take possession of the lands embraced in such new location, that may be required for the construction and maintenance of said road on such new line, and the convenient accommodations appertaining to the same, and acquire the same either by agreement with the owner or owners, or by such proceedings, as near as may be, as are authorised under the preceding sections of this act, and use the same in place of the line for which the new line is substituted.

Sec. 23. Whenever the track of said railroad shall cross a railroad

or highway, such railroad or highway may be carried under or over the track, as may be found most expedient, and in cases where an embankment or cutting shall make a change in the line of such railroad or highway desirable, with a view to a more easy ascent or descent, the said company may take such additional lands for the construction of such road or highway on such new line, as may be deemed requisite by said directors. Unless the lands so taken shall be purchased or voluntarily given for the purposes aforesaid, compensation therefor shall be ascertained in the manner in this act provided, as nearly as may be, and duly made by the said corporation to the owners and persons interested in such lands, the same, when so taken on compensation made, to become part of such intersecting railroad or highway, in such manner and by such tenure as the adjacent parts of the same highway may be held for highway purposes.

Sec. 24. If any such corporation shall, for its purposes aforesaid, require any land belonging to the people of this state, or to any of the counties or towns, the commissioners of the land office, and county and town officers respectively having charge of such land, may grant such lands to such corporation, for a compensation which shall be agreed upon between them, and if they shall not agree upon a sale and price, the same may be taken by the corporation as is before provided in respect to other cases.

Sec. 25. If the transportation of property on the railroad of any company formed under this act, running parallel or nearly parallel to any canal of the state, and within thirty miles of said canal, other than ordinary baggage of passengers transported thereon, shall in the opinion of the legislature, divert business of transporting property from any of the canals belonging to this state, the company owning such railroad shall pay to the canal fund, on all property transported upon its railroad other than the ordinary baggage of passengers transported thereon, the same tolls that would have been payable to the state, if such property other than such baggage, had been transported on any of such canals. And every such company shall make returns, at such time and in such manner as the commissioners of the canal fund shall prescribe, of all the property transported on its railroad, except the ordinary baggage of passengers transported on the same. And the said commissioners are hereby authorized and required to prescribe the manner in which such tolls so payable to the canal fund by such company, shall be collected and paid, and to enforce the collection and payment thereof, and to make such regulations as they shall deem proper for that purpose; and every such company that shall neglect or refuse to comply with any such regulation shall forfeit to the people of this state the sum of five hundred dollars for every day it shall so neglect or refuse; and in every case of such forfeiture it shall be the duty of the attorney general to prosecute such company for the penalty, in the name of the people.

Sec. 26. If the legislature of this state shall, after the expiration of ten, and within fifteen years from the completion of any such road, make provision by law for the re-payment to any such company of amount expended by them in the construction of the said road, to-

gether with all monies for permanent fixtures and the actual value of the cars, engines, machinery and chattels, and real property then in use for the said road, with interest on such sums at the rate of ten per cent. per annum, together with all monies expended by said company for repairs or otherwise, for the purposes of said road, after deducting the amount of toll, freight, and passage money received on said road, then the said road with all its fixtures and appurtenances aforesaid shall vest in and become the property of the people of this state.

Sec. 27. Every conductor, baggage master, engineer, brakeman, or other servant of any such railroad corporation employed in a passenger train, or at stations for passengers, shall wear upon his hat or cap, a badge, which shall indicate his office, and the initial letters of the style of the corporation by which he is employed. No conductor or collector without such badge, shall demand, or be entitled to receive from any passenger, any fare, toll or ticket, or exercise any of the powers of his office, and no other of the said officers or servants without such badge, shall have any authority to meddle or interfere with any passenger, his baggage or property.

Sec. 28. Every such corporation shall make an annual report to the state engineer and surveyor, of the operations of the year, ending on the first day of January, which report shall be verified by the oaths of the treasurer, and acting superintendent of operation, and filed in his office by the twentieth day of January in each year, and shall state :

1. The capital stock and the amount actually paid in.
2. The amount expended for the purchase of land, for the construction of the road, for buildings, and for engines and cars, respectively.
3. The amount and nature of its indebtedness and the amount due the corporation.
4. The amount received for the transportation of passengers, of property, of the mails, and from all other sources.
5. The amount of freight, specifying the quantity in tons, of the products of the forest, of animals, of vegetable food, other agricultural products, manufactures, merchandize, and other articles.
6. The amount paid out for repairs, engines, cars, building, and salaries.
7. The number and amount of dividends, and when paid.
8. The number of engine houses and shops ; of engines and cars, and their character.
9. The number of miles run by passenger, freight, and other trains respectively.
10. The number of men employed, and their occupation.
11. The number of persons injured in life or limb, and the cause of such injuries.
12. Whether any accidents have arisen from carelessness or negligence of any person in the employment of the corporation, and whether such person is retained in the service of the corporation.

Sec. 29. Any such corporation which shall neglect to make such report, shall be liable to a penalty of two hundred and fifty dollars, to be sued for in the name of the people, for their use.

Sec. 30. The legislature may, when any such railroad shall be open-

ed for use, from time to time alter or reduce the rates of toll, freight, fare, or other profits upon such road; but the same shall not, without the consent of the corporation, be so reduced, as to produce with said profits less than ten per centum per annum, on the capital actually paid in: nor unless on an examination of the amounts received and expended, to be made by the state engineer and surveyor and the comptroller, they shall ascertain the net income derived by the company from all sources for the year then last past, shall have exceeded an annual income of ten per cent. upon the capital of the corporation actually paid in.

Sec. 31. Any such corporations shall, when applied to by the post-master-general, convey the mail of the United States on their road or roads respectively; and in case such corporation shall not agree as to the rate of transportation therefor, and as to the time, rate of speed, manner, and condition of carrying the same, it shall be lawful for the Governor of this State, to appoint three commissioners, who, or a majority of whom, after fifteen days' notice in writing of the time and place of the meeting to the corporation, shall determine and fix the prices, terms, and conditions aforesaid: but such price shall not be less for carrying said mails in the regular passenger trains than the amount which such corporation would receive as freight on a like weight of merchandize transported in their merchandize trains, and a fair compensation for the post office car. And in case the post-master-general shall require the mail to be carried at other hours or at a higher speed than the passenger trains be run at, the corporation shall furnish an extra train for the mail, and be allowed an extra compensation for the expenses and wear and tear thereof, and for the service to be fixed as aforesaid.

Sec. 32. If any passenger shall refuse to pay his fare, or toll, it shall be lawful for the conductor of the train and the servants of the corporation to put him out of the cars at any usual stopping place the conductor shall elect.

Sec. 33. Every such corporation shall start and run their cars for the transportation of passengers and property at regular times to be fixed by public notice, and shall furnish sufficient accommodations for the transportation of all such passengers and property, as shall within a reasonable time previous thereto, offer or be offered for transportation, at the place of starting and the junctions of other railroads, and at sidings and stopping places, established for receiving and discharging way passengers and freight; and shall take, transport, and discharge such passengers and property at, from, and to such places, on the due payment of the tolls, freight, or fare legally authorized therefor.

Sec. 34. In case of refusal by such corporation or their agents so to take and transport any passenger or property, or to deliver the same or either of them at the regular or appointed time, such corporation shall pay to the party aggrieved, all damages which shall be sustained thereby with the costs of suit.

Sec. 35. A check shall be affixed to every package or parcel of baggage, when taken for transportation by the agent or servant of such

corporation, and a duplicate thereof given to the passenger or person delivering the same on his behalf. And if such check be refused on demand, the corporation shall pay to such passenger the sum of ten dollars to be recovered in any action of debt, and further no fare or toll shall be collected or received from such passenger, and if such passenger shall have paid his or her said fare, the same shall be refunded by the conductor in charge of the train; and on producing said check, if his or her baggage shall not be delivered to him or her, he or she may himself or herself be a witness in any suit brought by him or her to prove the contents and value of said baggage.

Sec. 36. In forming a passenger train, baggage, or freight, or merchandize or lumber cars, shall not be placed in rear of passenger cars; and if they, or any of them shall be so placed, and any accident shall happen to life or limb, the officer or agent who so directed, or knowingly suffered such arrangement, and the conductor and engineer of the train, shall each and all be held guilty of intentionally causing the injury, and be punished accordingly.

Sec. 37. A bell of at least thirty pounds weight shall be placed on each locomotive engine, and be rung at the distance of at least eighty rods from the place where the railroad shall cross any road or street, and be kept ringing until it shall have crossed such road or street: under a penalty of fifty dollars for every neglect, to be paid by the corporation owning the railroad, one half thereof to go to the informer and the other half to the state, and also be liable for all damages which shall be sustained by any person, by reason of such neglect.

Sec. 38. Every such corporation shall cause boards to be placed, well supported by posts or otherwise, and constantly maintained across each public road or street where the same is crossed by the railroad on the same level; said boards shall be elevated so as not to obstruct the travel, and to be easily seen by travelers; and on each side of such boards, shall be painted in capital letters of at least the size of nine inches each, the words "railroad crossing, look out for the cars while the bell rings;" but this section shall not apply to streets in cities or villages, unless the corporation be required to put up such boards by the officers having charge of such streets.

Sec. 39. If any person shall, while in charge of a locomotive engine running upon the railroad of any such corporation, or while acting as the conductor of a car or train of cars on any such railroad, be intoxicated, he shall be deemed guilty of a misdemeanor.

Sec. 40. If any person shall wilfully do, or cause to be done, any act or acts whatever, whereby any building, construction, or work of any such corporation, or any engine, machine, or structure, or any matter or thing appertaining to the same, shall be stopped, obstructed, impaired, weakened, injured, or destroyed, the person or persons so offending shall be guilty of a misdemeanor, and shall forfeit and pay to the said corporation, treble the amount of damages sustained by means of such offence.

Sec. 41. All penalties imposed by this act, except the penalty imposed by the twenty-fifth section thereof, may be sued for by any district attorney, and in the name of the people of the State of New York,

and if such penalty be for a sum not exceeding one hundred dollars, then such suit may be brought before a justice of the peace.

Sec. 42. Such corporation shall erect and maintain fences on the sides of the road, of the height and strength of a division fence as required by law, with openings and gates therein, and farm crossings of the road for the use of the proprietors of lands adjoining such railroad, and also construct and maintain cattle guards at all road crossings, suitable and sufficient to prevent cattle and animals from getting on the railroad. Until such fences and cattle guards shall be duly made, the corporation and its agents shall be liable for all damages which shall be done by their agents or engines to cattle, horses, or other animals thereon, and after such fences and guard shall be duly made, the corporation shall not be liable for any such damages, unless negligently or wilfully done, and if any person shall ride, lead, or drive any horse or other animal upon such road, and within such fences and guards other than at farm crossings, without the consent of the corporation, he shall for every such offence, forfeit a sum not exceeding ten dollars, and shall also pay all damages which shall be sustained thereby to the party aggrieved.

Sec. 43. Every such corporation shall, within a reasonable time after their road shall be located, cause to be made:

1. A map and profile thereof, and of the land taken or obtained for the use thereof, and file the same in the office of the state engineer and surveyor. And also like maps of the parts thereof located in different counties, and file the same in offices for recording deeds, in the county in which such parts of said road shall be, there to remain on file as of record forever. Every such map shall be drawn on a scale and on paper, to be designated by the state engineer and surveyor, and certified and signed by the president of such corporation.

2. A certificate specifying the line upon which it is proposed to construct the railroad, and the grades and curves.

Sec. 44. If any such corporation shall not, within two years after its incorporation, begin the construction of its road, and expend thereon ten per cent. on the amount of its capital, and finish the road and put it in full operation in five years, its act of incorporation shall become void.

Sec. 45. The legislature may, at any time, amend, or annul, or repeal any incorporation formed or created under this act; but such amendment or repeal shall not, nor shall the dissolution of any such corporation, * its stockholders or officers for any liability which shall have been previously incurred.

Sec. 46. All existing railroad corporations within this state, shall respectively have and possess all the powers and privileges, and be subject to all the duties, liabilities, and provisions contained in this act, so far as they shall be applicable to their present conditions, and not inconsistent with their several charters; and all railroad companies that are now constructing their roads, may acquire title to lands necessary for that purpose, under the provisions of this act: *Provided* that nothing in this act contained, shall authorize any existing rail-

* An omission in the paper from which this law is copied.

road company to carry freight without the payment of canal tolls, pursuant to the act entitled "An act relating to the transportation of freight on certain railroads," passed May 12, 1847.

Sec. 47. This act shall take effect immediately.

State of New York, Secretary's office. } I have compared the preceding with the original law on file in this office, and do certify that the same is a correct transcript therefrom and of the whole of said original.

CHRISTOPHER MORGAN, *Secretary of State.*

Amer. Mining Jour.

On Tables for Setting out the Width of Cuttings and Embankments on Sidelong Ground; and also Formulæ for Computing the Area of Vertical Section.

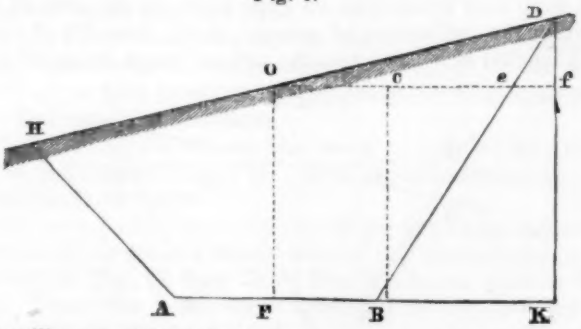
By R. G. CLARK, C.E.

The object of this paper is to investigate some simple formulæ, and from thence to construct some tables, to enable the assistant engineer or contractor to set out the widths of cuttings and embankments on sidelong ground; and also to calculate the solid content of any portion of the ground. The subject may be resolved in the following proposition:—

Given the ∠ of inclination of ground, the depth (from field-book, &c.) of ground to the centre of balance or formation level, and the ratio of the slopes; to determine where they will meet the ground at surface.

Let H A F B D (fig. 1.) be a vertical section of the ground; A B the formation line, represented by $2b$; the given angle of inclination of ground H D with the horizon by θ; the given depth O F from the stake O perpendicular to centre of formation level denoted by a.

Fig. 1.



1. We will proceed first, to determine a formula for O D. Let it be x; draw D K perpendicular to A B produced; O f parallel to A B K. Let D B be the given slope m base to 1 perpendicular; draw the vertical B C.

Let D $f=y$; then O c=F B=b; $ef=my$; also by similar triangles, C $e=ma$. $\therefore$ O $f=b+ma+my$.

Now, by triangle O *f* D, right angle at *f*, we have

$$1 : x :: \sin\theta : y. \quad \therefore y = x.\sin\theta.$$

Again, $1 : x :: \cos\theta : b + m\,a + m\,y.$

$$\therefore x.\cos\theta = b + m\,a + m\,y.$$

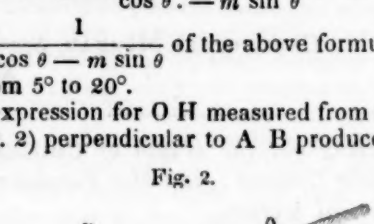
Eliminating y, then $x(\cos\theta - m\sin\theta) = b + m\,a$;

$$\text{therefore, } x = \frac{b + m\,a}{\cos\theta . - m\sin\theta} \quad \ldots\ldots\ldots\ldots (1)$$

From the factor, $\frac{1}{\cos\theta - m\sin\theta}$ of the above formula, the Table No. I. is computed from 5° to 20°.

2. To find an expression for O H measured from O on the descent. Draw H M (fig. 2) perpendicular to A B produced. Let H A be

Fig. 2.



the given slope, ratio as before. Let H M $= y'$; then will A M $= m\,y'$.

Therefore, H G $=$ N F $= b + m\,y'$ also O $g = a - y'$.

By the triangle H *g* O we have $1 : x' :: \sin\theta : a - y$;

therefore, $a - y' = x'.\sin\theta$; and $y' = a - x'.\sin\theta$.

Again, $1 : x' :: \cos\theta : b + m\,y'$.

Eliminating y, we have $x'(\cos\theta + m\sin\theta) = b + m\,a$;

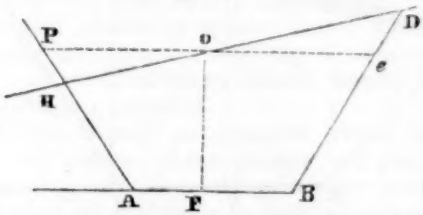
$$\text{therefore, } x' = \frac{b + m\,a}{\cos\theta + m\sin\theta} \quad \ldots\ldots\ldots\ldots (2)$$

From this expression, Table No. II. is calculated by the factor

$$\frac{1}{\cos\theta + m\sin\theta}.$$

3. We shall now investigate an expression for the area of the vertical section; the inclination of ground, depth, breadth of formation level, and lengths x, x', and also the ratio of slope, being all given.

Fig. 3.



Through centre O (fig. 3), drew P *e* parallel to A B; then P O $= b + m\,a$. $\therefore$ area of trapezoid P A B $e = (2\,b + m\,a)\,a$;

area of triangle P O H $= \frac{1}{2}\sin\theta.\,x'\,(b + m\,a)$;

and area of triangle D O $e = \frac{1}{2}\sin\theta\,x\,(b + m\,a)$.

Consequently, the whole area of trapezium or vertical section = area P A B *e* + area triangle D O *e* — area triangle P O H =

$$(2\,b+m\,a)\,a+\tfrac{1}{2}\,(b+m\,a)\,(x-x')\sin\theta \quad \ldots\ldots\ldots \quad (3)$$

The first column of the table gives the angle of inclination of the ground, and the adjoining column the nat. sines to three places of decimals, to facilitate working out the area, as in equation (3). We shall now commence with the following Rules.

I. *To find the two lengths* O D *and* O H :—Rule. Add the half-breadth of formation level to the product of the slope and given depth; then multiply this sum by the corresponding tabular number, then will each product be equal to each length required.

II. *To find the area of section* H A B D :—Rule. 1st. Add the formation level to the product of the ratio and depth, and multiply this sum by the depth. 2ndly. Add half the formation level to the product of ratio and depth; multiply this sum by the difference of the two lengths, and again by nat. sine of angle. Add these two products, and their sum will be the area.

Example 1.—Given the angle of inclination of ground 18°; slope, 1 to 1; depth, 45 feet; and breadth of formation level, 30 feet. To find distances of centre stake, area of section, and cubic content, when 100 feet in length.

Here $b+a\,m=15+45=60$; $m=1$; $\theta=18°$; its nat. sin = ·309 . ·.

1.557 × 60 = 93·429 = O D. ·799 × 60 = 47·940 = O H.

By formula (3) we have (30 + 45) 45 + ½ (15 + 45) (45·48) ·309 = 75 × 45 + 30 × 45·48 × ·309 = 4099·5 area required.

Cubic content = 409950·0.

Example 2.—Given angle of inclination of ground, 20°; slope, 1½ to 1; depth, 50 feet; and breadth of formation level, 30 feet. To determine distances and also area.

Here $a=50$; $b=15$; $m=1\frac{1}{2}=\frac{3}{2}$; $\theta=20°$; its nat. sin = ·342 . ·. $b+a\,m=15+75=90$.

Now, 2·344 × 90 = 210·96 = O D. ·781 × 90 = 70·29 = O H.

By formula (3) for area we have

(30 + 75) *a* + ½ (15 + 75) (140·67) ·342 = ·7174 area required.

Example 3.—Given the inclination of ground, 18°; slope to be 2 to 1; depth from field-book, 20 feet; breadth of formation level, 30 feet. To find area and distances.

Here $b=15$; $a=20$; $\theta=18$; $m=2$. . ·. $b+a\,m=55$.

55. × 3·000 = 165. = O D. 55. × ·641 = 35·25 = O H.

By formula (3) we have

(30 + 40) 20 + ½ (15 + 40) (129·74) ·309 = 2505 area required.

Remark.—If the ground should ascend and descend, as in the adjoining diagram (fig. 4), then Table No. II is to be used to find the distances. Table No. I will in like manner be required for ground descending from centre, as in fig. 5.

Fig. 4.

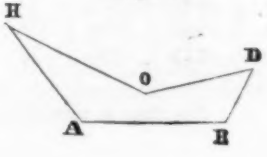
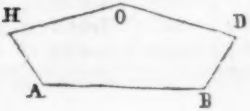


Fig. 5.



The tables will likewise do for embankments—No. I. for the ascent from centre stake, and No. II. for the descent.

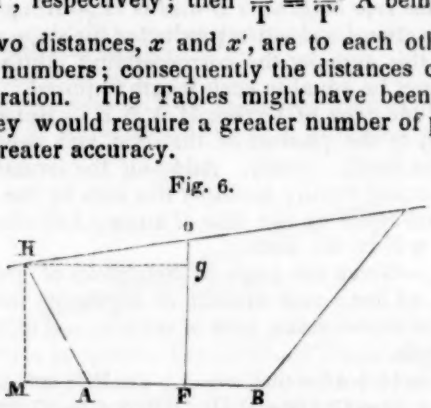
We shall now discuss the equations (1) and (2). Put them respectively under the following forms. T, T', being tabular numbers, $A = b + m\,a$.

$$X = T.A\,;\ \text{and}\ X' = T'.A.$$

Divide by T, T', respectively; then $\frac{X}{T} = \frac{X'}{T'}$, A being eliminated.

Therefore the two distances, x and x', are to each other as their respective tabular numbers; consequently the distances can be proved by a second operation. The Tables might have been carried up to 45°, but then they would require a greater number of places of decimals to insure greater accuracy.

Fig. 6.



In taking the angle of inclination, the clinometer or common theodolite might be used; but if the spirit-level should be used, then we have only to measure from O downwards *any* distance, O r, (fig. 6), and then take the height with instrument; and then will the sine of angle of inclination $O\,d\,s = r\,O\,d = \frac{\text{height}}{\text{distance}}$.

Angle.	Nat. Sin.	TABLE No. 1.—For O D.			TABLE No. 2.—for O H.		
		1 to 1	1½ to 1	2 to 1	2 to 1	1½ to 1	1 to 1.
5°	·087	1·100	1·156	1·217	·854	·881	·926
6°	·105	1·124	1·193	1·273	·832	·868	·910
7°	·122	1·148	1·230	1·323	·802	·851	·895
8°	·139	1·175	1·280	1·404	·780	·835	·885
9°	·156	1·203	1·328	1·496	·761	·820	·873
10°	·174	1·233	1·380	1·570	·752	·804	·856
11°	·191	1·265	1·437	1·666	·736	·790	·850
12°	·208	1·279	1·500	1·778	·700	·780	·844
13°	·225	1·330	1·566	1·902	·705	·763	·841
14°	·242	1·372	1.655	2·055	·696	·752	·826
15°	·259	1·414	1·731	2·230	·676	·740	·818
16°	·276	1·459	1·825	2·463	·663	·727	·800
17°	·292	1·506	1·930	3·600	·645	·717	·801
18°	·309	1·557	2·050	3·000	·641	·710	·799
19°	·326	1·613	2·186	3·040	·630	·698	·787
20°	·342	1·673	2·344	3·913	·611	·680	·781

Improvement in Railway Sleepers.

The chief objection that has been raised against the employment of sleepers in the construction of railways, is their liability to decay, and the necessity that exists of renewing them from time to time. Kyan's corrosive sublimate, which has been employed for preserving them, has been found in France and elsewhere to be too expensive a process, and crude creosote, different sulphates, and pyrolignite of iron, have all been successively tried, but with results by no means satisfactory. We are therefore glad to introduce Mr. Fred. Busse's invention for constructing railway sleepers from a certain compound cast around a wooden frame, which he has called "*terresin.*" The following is his own description of his invention:—

"My sleepers are manufactured by hand, just on the spot where they are wanted. These sleepers have been tried on the Leipsic and Dresden, and the Dresden and Silesia lines, and combine all the advantages which are reasonably to be expected from a good sleeper. They are easy to make, are cheap and solid, and promise a duration for a period of time not to be calculated; supposing only thirty years, it greatly exceeds that of wooden sleepers. I have cast sleepers, according to my invention, 8 ft. long, 14 in. broad at the base, at an outlay amounting to less than 1 Prussian dollar (3s.) the piece. The yet good pieces out of the old worn sleepers may be advantageously cut for frame top pieces. The principle of my invention is to inclose a frame of entirely dry, well-seasoned wood, air-tight, in a substance which is not affected by the influences of wet and air, it being the result of experience that under such circumstances, the wood will not be destroyed at all, or at least will last by far longer. The method after which I build and compose the said sleepers is as follows:—I take two pieces of wood, dried to the highest degree by artificial heat in a stove. Immediately after drying, I dip those pieces in a boiling compound of 10 lb. of brimstone, and 100 lb. of coal tar, to which I add 80 lb. of very fine powder of caustic lime. This done, I scratch or take off with a knife the superfluous compound, leaving only a thin coating on the wood. The pieces of wood thus prepared are now brought anywhere along the line of the railway where coarse gravel is to be found; it may be taken out of the soil or from a river. The latter is to be preferred, as containing less earthy matter. The gravel mixed with fine or coarse sand, or small stones—the latter till to an inch diameter—ought to be dried, or rather heated before used. The wooden frame is placed, the topside to the bottom, in a conical iron or wooden mould—the latter material is to be preferred—which is to be filled up with the compound which I call "terresin" and which is prepared as follows: I take an iron vessel, large enough to hold a quantity of terresin, sufficient to cast three sleepers; I melt 10 lb. of brimstone, add 75 lb. of stiff coal-tar, and mix it by stirring with 100 lb. of fine powder of well-dried fresh-burnt caustic lime, which is slaked in the air or with a little water. Where powdered chalk or plaster are cheaper, these materials may be used as well The exact

quantity of lime, chalk, or plaster, for a given quantity of brimstone and coal-tar is dependent upon the quality of the said materials, and the choice of the right proportion must be left to the best judgment of the manager. In case the tar should not be of good quality, a little resin and grease may be added. To this compound add, always stirring and turning the mass over a gentle fire, 10 to 12 cubic feet of that before-mentioned dried or heated gravel, and fill or rather ram the thick hot compound into the moulds in which the frames are placed. The moulds must before-hand be well coated with clay, and afterwards sifted over with fine ash, to prevent the compound adhering to the mould. Before the compound is cooled, it is advisable to pierce one or two holes through the top part of the sleepers, vertically to the bottom, with an iron bar. By these means the sleepers and rails may be levelled or balanced as accurately as possible, by pressing dry sand into the holes, which will leave the sleeper spreading under the bottom part. The sleeper being completely cooled, it is taken out by overturning the mould. The top pieces, where the rail or the chair is to be screwed (which is by far the better process) or nailed down, must be left free from the compound, and are only coated with the thin hot compound, without the gravel, which may be repeated after having fastened the chair, to secure the top pieces against the influence of air and water.

By this contrivance we get a very cheap sleeper, as hard as stone, and extremely heavy—400 lb.—without losing the elasticity which is wanted to a certain degree, and allows, what is a matter of importance, that the rails or chairs are situated directly on wood. Here I feel obliged to remark that we have found it in Germany a good practice to support the sleepers only on the two extremities, leaving the gravel or sand loosely underneath the middle part, an experience undoubtedly made likewise in England. It is a matter of importance that any kind of wood may be employed, and that the construction of the frame and the size of the sleepers may be altered according to circumstances. The sleepers may be made much wider with a proportionate small increase of expense. The thin terresin, without gravel, can be used with great advantage to cover the surface of the wooden sleepers already laying, which after that preparation, will last longer. In case of using the terresin for this purpose, I expect a commission of £1 for every 1000 pieces thus covered, and if it is employed for covering roofs, bridges, viaducts, houses, pavements, floors, &c. 2d. for the square yard. For those different purposes it is advisable to add about 3 to 10 per cent. of animal grease, tallow, train-oil, &c. For floors, pavements, &c. the same compound is used as for sleepers, without any grease.

Regarding the resistance against pressure, it is to be observed, that sleepers on the Leipsic and Dresden Railway have undergone, without the least alteration, the pressure of the heaviest trains, with 20 ton locomotives. Their firmness and compactness is beyond all doubt, and their cohesion so great, that it was only with great difficulty that a sleeper of this kind could be broken up with iron chisels and hammers. The Artizan.

Description of a Method of setting out Railway Junctions. *By* ARTHUR BEAULANDS.

The object of the paper was to supply a methodical rule for setting out that portion of a branch line of railway included between the rails of the main line.

The author observed that, in all ordinary cases, the curve of the branch line could not be set out from the main line, which was supposed to be straight, by the ordinary methods of setting out railway curves, since the Junction was required to make an offset of four to five inches in the length of the switch-rail, which was much greater than the offset made from the tangent in the same length by a curve of moderate radius, so that it was necessary to make the Junction line abruptly at a finite angle with the main line.

He therefore considered the Junction curve to be determined by its passing through three given points; namely, the two extremities of the switch rail and the furthest point of crossing; and from these data he showed how the radius and centre of the circular arc might be found, as well as the positions and angles of the various crossings.

To render the method more easy of application, the author gave a table calculated from the principles and formulæ laid down in the paper, assuming an ordinary form of the switch, and a series of values of the lead, a distance of the furthest crossings extending to the greatest limit likely to occur in practice.

In the course of the discussion which ensued upon this method as compared with the ordinary system of setting out Junctions by a comparatively empirical rule, well understood and practised by the platelayers on railways, Mr. Wild's switch was alluded to and exhibited. In this switch all notching and inequality in the bearing surfaces of the fixed rails were shown to be avoided, by the ends of the tongues being housed under such surfaces instead of being notched into them; the tongues being consequently at their points, and for some distance beyond them, lower than the fixed rails, exercised, where they were weakest, merely a lateral action against the wheels without bearing any of the weight of the passing trains.

Several engineers who had employed these switches extensively, expressed themselves relative to them in very commendatory terms, and stated that they were not only manufactured in a very superior manner, but that their action was very perfect, and that they tended greatly to the prevention of accidents in railway traveling.—*Proc. Inst. Civ. Engineers.* **Artizan, May, 1848.**

Observations on the Resistances to Railway Trains at different Velocities. *By* MR. D. GOOCH, of the Great Western Railway.

For the purpose of performing the experiments, a dynamometer carriage was constructed at Swindon, in which all the results required were registered upon a large scale, on the same roll of paper, thus

exhibiting at one view, and in the same period of time, the tractive power exerted upon the train, and the force and direction of the wind; the registration of the results was made upon the paper at every sixteenth part of a mile, and the time was registered in correspondence with the distance traversed during every fifth part of a second. The dynamometer spring used was 7 ft. 6 in. long, and very carefully arranged. It was only necessary to count the number of seconds or fractions of a second, in one or more of the distance divisions, and the speed was accurately ascertained. The force and direction of the wind was ascertained by a wind gauge, placed 5 feet above the top of the carriage, with the connexion brought down to pencils, which indicated on the same sheet all the results. Indicator cards were also taken simultaneously from the steam cylinders as frequently as was practicable, but not continuously, as it was a service of some danger, the experimenter being obliged to sit on the buffer-beam of the engine at a velocity of 60 miles per hour, and in that windy position to take off four sets of cards in three quarters of a minute. The spot selected for performing the experiments was one mile of railway perfectly straight and level, and nearly on the surface of the ground; and in the plan the height of the trees, hedges, and every intervening object which could affect the influence of the wind, is clearly marked. The experimental train consisted of first and second-class carriages, each on six wheels, 4 feet diameter, taken indiscriminately from the working stock, and loaded with iron to represent a fair load of passengers, giving a gross weight for each of 10 tons. The experiments were tried with various weights and speeds up to 100 tons and to 62 miles per hour, and the results were classified and arranged in a tabular form, with copious explanatory headings, so as to render reference to them exceedingly easy.

The author first reviewed the deductions of Mr. Wyndham Harding's formula, which was given at the discussion at the Institution in 1846, and gave his reasons for dissenting from that formula. He then examined critically several experiments recorded in the tables, stating candidly all the exceptions that could be taken to them; showing that although there was a difference of as much as 72 per cent. shown between the resistance as calculated by Mr. Harding's formula and the experiments made by Mr. Gooch, that difference might be accounted for by the methods employed by Mr Harding, which were objected to, as calculated to produce erroneous results: viz., allowing carriages to run down inclines by their own gravity, using wheels of 3 feet diameter instead of 4 feet, having a much greater length of train for the wind to act upon, &c. He reviewed the great effect of a side wind against a train—driving the flanches of the wheels against the rails; and argued that the length of a train of carriages was much more important than its own weight. The author did not offer any formula that should be applicable for calculating the resistance of all railway trains; but his tables gave examples of almost every case that could occur, and thence data could be supplied for those who wished to carry the investigation further, and make a formula for themselves. He arrived at the conclusion that in practice the friction of the axle-

journals was not a constant quantity at all speeds, and thought that the number and diameter of the wheels in a train, in proportion to the weight, should form elements in any general formula. He showed by experiments that the total atmospheric resistance to a train weighing 50 tons differed but slightly from that to a train of 100 tons weight, if the carriages were small and the train long in the one case, and the reverse in the other case.

The general result of the diagram of resistance with trains of 100 tons and with 50 tons, showed that the resistance calculated by the narrow-gauge formula with a 50 ton train, at 62½ miles per hour, was 37 lb.; with a train of 100 tons, by the same formula, at 61 miles, it was 31½ lb. The broad gauge resistance, with a train weighing 50 tons, at 62½ miles per hour, was under 23 lb.; and with a train weighing 100 tons, at 61½ miles per hour, was 22½ lb. We cannot, of course, give fully the results, except in a comprehensive form, but such were the general results.

The author concluded his paper by saying that it appeared to him necessary, before any general formula for calculating the resistance to railway trains could be made, that the value of the following elements, necessary in such formula, should be determined by experiments:—

1. The axle-journal friction, at different velocities and with different weights, per square inch of journal surface.
2. The resistance to the rotation of the wheels and axles per pair, at different velocities, and with different diameters.
3. The resistance due to the rolling of the wheels upon the rails, with different weights upon them, and with different diameters.
4. The resistance due to the passage of the train through the atmosphere, at different velocities, with different proportions of weight, and length and breadth of train.
5. The resistance due to the oscillation or unsteady motion of the train, at various speeds.

The author considers that all these values might be determined, with a considerable degree of accuracy, by careful experiment.—*Proc. Inst. Civ. Engineers.* Lon. Civ. Eng. & Arch. Jour.

On the Prevention of Priming in Steam Boilers. By JOHN HARRIS, *Engineer.*

In an article "On the Prevention of Priming in Steam-Boilers," Mr. W. Scotton, engineer, R. N., proposes to use oily or fatty substances for the prevention of priming. It is a well-known fact that oil, or tallow, or any fatty substance, is a great preventive of priming in ordinary steam boilers, but for locomotive boilers the case is quite the reverse. For instance, when a new engine is placed on a line, it is continually priming until the boiler is well washed and cleansed; locomotive boilers all being tubular, and having very little steam room, the space allowed is necessarily very small. Another disadvantage attending the use of oily matters is, their tendency to cause the impurities held in solution in the water to be deposited on the lower

plates of the boiler, in contact with the fire. As a proof of the above facts, I beg to state, that I fixed a high-pressure engine, of 10-horse power, at the London-Bridge Railway Station, about six years ago; but the steam from the exhaust-pipe proving an annoyance on the line, and there being a water-tank over the engine, containing 18,000 gallons, I proposed, and was authorized, to fix a coil of 4-inch pipe at the bottom, which effectually condensed the whole of the steam. In a few weeks after, however, we were nearly causing an explosion by returning the condensed water back to the boiler, in consequence of the oily matter combining with the water from the steam cylinder. We were greatly surprised one day, while the engine was at full work —the steam being at that time at a pressure of 50 lbs. on the square inch—to hear a loud hissing noise in the furnace. On opening the fire-door, we saw that a row of rivets, 5 feet long, had given way, and that the water was coming out with enormous force. We instantly put out the fire, and on the following morning I went into the boiler, to ascertain the cause of so unusual an accident—the boiler being provided with a gauge-glass and two gauge-cocks, and the water at the time having been rather higher in the glass, and fuller at the cocks, than usual. On entering the boiler, I found a mass of sediment over the whole of the rivets which had given way, about 3 inches thick, which prevented the water coming in contact with the plate of the boiler, and thereby caused the rivets to become red hot, and a consequent expansion of the sediment, which allowed the water to come suddenly in contact with the rivets and plates of the boiler. We examined the sediment taken out, in various ways, and found it to contain at least 50 per cent. of oily matter. The water used was Thames water. Since that time—that is to say, for the last five years —we have used, as a preventive against a similar occurrence, a small quantity of common soda, which, combining with the oil or tallow, causes the whole of the earthy matter held in solution to float on the surface of the water; and, by means of a blow-off pipe, placed on the surface of the water in the boiler, the whole of the sediment is removed. The consequence has been, that we have had not the least occasion to clean the interior of the boiler, the plates and rivets remaining as clean as when first manufactured. Mech. Mag.

London-bridge Railway Station, May 2.

AMERICAN PATENTS.

List of American Patents which issued in the month of August, 1842, with Exemplifications, by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in the Manufacture of Iron;* John S. Gustin, (assignor to Peter Cooper,) City of New York, August 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use of atmospheric air, introduced directly upon

the heated iron in the furnace, in the manner and for the purposes set forthand described."

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2. For an *Improvement in Looms for weaving Counterpanes, &c.;* Erastus B. Bigelow, Lancaster, Massachusetts, August 2, (antedated May 2d, 1842.)

The patentee says,—"The improvement for which I now claim a patent, consists: First, in the manner in which I construct and arrange the toothed gearing, so as to obtain the power that is necessary for the lifting of the weights which are suspended from the harness in looms, intended for figured weaving, which weight with the friction consequent thereon, produces a very considerable resistance which it is necessary to overcome.

"Secondly, In the arrangement of the parts concerned in the stopping of the loom by the manner in which the protecting rod acts thereon.

"Thirdly, In an apparatus for counteracting the momentum of the loom, when it is thrown out of gear for changing the spools, or for any other purpose."

Claim.—"What I claim as constituting my improvement on the power loom for weaving counterpanes and other figured fabrics, and which I desire to secure by letters patent, is the manner in which I have combined the rotating shaft with the other parts connected with the stopping of the loom: that is to say, I claim the allowing of the bayonet of the protecting rod to pass freely beyond the projecting piece on the rotating rod or lever, against which it strikes, so as to prevent the sudden arresting of the lathe, or the motion of the loom by said bayonet, when the shuttle does not arrive at its place within the shuttle box, but remains in the warp; and in this part, I likewise claim the combining with the rotating shaft, or lever, the sliding shaft and its appendages for acting upon the stop lever, and the suddenly arresting the motion of the loom by said stop lever at the time, and substantially in the manner herein described.

"I claim likewise the combination of the friction pulley and band, with the apparatus for stopping the loom, said friction pulley and band, or other device, being connected with the loom, and operating substantially in the manner and for the purpose herein set forth."

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3. For an *Improvement in Clocks;* Evans Casselberry, St. Louis Missouri, August 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode herein described, of applying the expansion and contraction of mercury or other fluids, for the purpose of operating clocks, and other combinations of mechanism driven by springs: that is to say, I claim operating the shaft on which the driving spring is wound up by means of the expansion and contraction of mercury acting in a cylinder against a piston; said cylinder and piston being combined by means of a movable frame, consisting of bars and a ratchet wheel, with the aforesaid shaft, all as herein set forth.

"I also claim the combination of the shaft constructed in two parts, with the spring and pin on said spring as described, for the purpose herein specified."

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4. For an *Improvement in Wind-Mills;* Alexander McGrew, Cincinnati, Hamilton county, Ohio, August 2.

Claim.—"I do not claim to have invented the wind-mill, but the nature of my invention consists in an improved mode of constructing the wind wheel, screening or protecting one part of the floats or fans from the action of the wind, while at the same time the other receives its full force nearly at right angles to their plane or surface, so as to produce more power, and in having the different parts so contrived as that it shall, in a great measure, regulate itself, and admit of its being used stationary or in locomotion, either in wind or water.

"What I claim as my invention, and wish to secure by letters patent, is the revolving frame and screen in combination with the regulator or governor, in the manner and for the purpose herein set forth."

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5. For an *Improvement in Cheese Presses;* Chester Stone, Rootstown, and F. K. Collins, and G. S. Collins, Ravenna, Ohio, Aug. 6.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the application of the power of the screw and falling lever in a self-acting press, in manner as above described, for the purpose of pressing cheese and other substances, whether arranged precisely in the manner herein set forth, or in any other mode, substantially the same."

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6. For an *Improvement in Steam Boilers;* Abram S. Valentine, Bellefonte, Centre county, Pennsylvania, August 6.

The patentee says,—"The nature of my invention consists in forming two square or other shaped reservoirs, which are connected together by tubes standing vertical, their ends opening into said reservoirs. The front tubes of the boiler thus constructed, are made to form the back of the fire chamber. From the lower reservoir, a fire grate extends upwards at an angle of about 70°; the smoke, &c., passes through between the pipes and up the chimney at the back of the boiler."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of the generator, consisting of the separate steam chamber or upper reservoir, and lower separate reservoir, so as to allow them to move apart, as the tubes which unite them expand in the manner above described, in combination with the fire chamber, formed between the tubes of the boiler and grate, constructed and arranged in the manner and for the purpose herein set forth."

7. For an *Improvement in cutting out Hoop and Basket Stuff;* Charles Stratton, Brattleboro, Windham county, Vermont, Aug. 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the knife and rest which regulates the thickness of the article to be cut as herein described, and also the combination of the knife and guide for the purpose and in the manner specified."

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8. For an *Improvement in Cooking Stoves;* Erastus Buck, Nunda, Alleghany county, New York, August 6.

The patentee says,—"The nature of my invention consists in placing the furnace or fire chamber over the oven nearly at the back part of the stove, and forming a diving flue on each side of the front doors of the fire chamber, which extends down under the oven and up in the rear of the fire chamber, and there connects with the pipe."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a fire chamber placed over the oven at its rear, with the diving flues projecting in front and passing around the oven in the manner and for the purpose herein described."

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9. For an *Improvement in Cotton Presses;* Parry W. Porter, Columbia, Maury county, Tennessee, August 11.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the before described addition of the levers, operated by the screw in such manner that, in turning the screw to the right or left, the operation of pressing will continue without cessation, as one pair of platens will be pressing the bales whilst the other pair will be receding from the opposite bales—the power applied being by means of cords and pulleys, or any convenient mechanical power. I likewise claim the combination of the curved levers as represented, and the movable fulcra by which the sides of the rhombus are drawn together as described."

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10. For an *Improvement in Lard Lamps;* John T. Creighton, Alexandria, D. C., August 11.

The patentee says,—"My improvement is in the conductors and in combining with the central conductors a sliding clasp which embraces them and the wick."

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the manner of holding the wicks by means of the sliding clasp and the central spring conductors, constructed, arranged, and operated in the manner set forth, or in any other mode analogous thereto."

11. For an *Improvement in the mode of changing Reciprocating into Rotary Motion for Steam Engines and for other purposes;* Alexander M. Bouton & Andrew Perry, Newark, Essex county, New Jersey, August 18.

The patentees say,—"The nature of our invention consists in our applying power by a certain combination of levers upon the edge or circumference of a wheel, which is hung upon the main shaft or axle used to propel a steam boat, or other main axles for driving machinery, in the room and place of an ordinary crank, by which mode we conceive that we gain power and save weight."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the levers in combination with the wheel, having notches cut on its rim and the arrangement of parts for pressing the levers into the notches for the purpose, and in the manner specified."

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12. For an *Improvement in Cutting the Threads on Wood Screws;* Cullen Whipple, (assignor to Alexander Hodges,) Providence, Rhode Island, August 18.

This machine is intended simply to cut the threads or worms upon the blanks, which are to be formed into wood screws, after the heading and cutting of the nicks or slits in the heads have been completed.

Claim.—"What I claim as new, and desire to secure by letters patent, are the following parts, and combinations of parts, as set forth in the foregoing specification:

"I claim the manner in which I have combined the shaft with the circular wedge on the shaft, so as to cause said circular wedge to raise the shaft by its action on the projecting piece and the tube, said tube being connected with the box, and the whole being arranged, and operating substantially as set forth.

"I claim the manner in which I have constructed, arranged, and combined the conical cam, furnished with the recesses, with the lever, the shaft, and the cutter arm, so as by their combined action, and that of their immediate appendages, the cutter may be forced against, and removed from, the blank to be cut, at the proper intervals, and in the manner described. I claim the regulating the feed of the cutter in its successive operations on the blank, by the raising of the conical cam, so as to cause a part of larger diameter to act upon the lever. I claim the so forming of what I have denominated the conical cam, as to give the desired taper to the screw, to be cut by means of the increasing radius of its curvature as set forth. I claim the manner of raising the conical cam by means of the lever, by the action thereon, of the pins on the ratchet wheel as set forth. I claim the manner in which I have combined, and arranged the lever, its catch, or pall; the cam on the shaft; the rim or flanch of the rachet wheel; and the clutch by means of its arm, so as to co-operate with each other, and with the lever, in governing and regulating the cutting of the screw. I claim the manner of making or forming the cutters or chasers, to be used in combina-

tion with a machine for cutting wood screws, said cutters having a groove formed along their cutting sides, so as to cause them to cut simultaneously on both sides of the thread, and finally to cut the edge of the thread itself, said groove being of the proper width and depth for that purpose, by which construction the cutters or chasers may be sharpened, by grinding or setting them to a simple bevel at their ends, without interfering with the notch or groove, by which they are made to cut on each side of and to form the thread."

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13. For an *Improvement in the mode of Securing a Bobbin in the Shuttle;* Daniel Leavitt, Cabotville, Hampden county, Massachusetts, August 18.

Claim.—"I claim the movable box, or socket, (which receives the head of the bobbin,) constructed as described, the same being arranged upon the spring lever, and operating substantially in the manner and for the purpose as herein set forth."

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14. For an *Improvement in Tanning Leather;* William Zollickoffer, Middleburgh, Carroll county, Maryland, August 18.

The patentee says,—"The nature of my invention consists in using in combination, the muriate of soda, supertartrate of potassa, and tartaric acid, as a bate for bating all description of hides and skins."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the muriate of soda, supertartrate of potassa, and tartaric acid, as a bate for bating all description of hides and skins as herein described."

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15. For an *Improvement in Water Wheels;* Joseph Durkee, Binghampton, Broome county, New York, August 25.

The improvement consists in the construction of the buckets so made, that the whole lateral and perpendicular pressure of the water used, acts to the greatest advantage in propelling the wheel by re-action.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of the taper bucket above described."

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16. For an *Improvement in Churning Butter;* N. H. Lindley, Redding, Fairfield county, Connecticut, August 25.

Claim.—"Having thus described my invention, I shall claim the combination of the vibrating floats or scrapers, fluted roller of the dashers, and the stationary bottom of the reservoir, the whole being constructed, and operating together, substantially in the manner and for the purposes as hereinbefore set forth."

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17. For an *Improvement in Locomotive Steam Engines;* Matthias W. Baldwin, Philadelphia, Pennsylvania, August 25.

Claim.—"What I claim as new, and desire to secure by letters patent, is principally the manner in which I connect the four truck wheels

with each other, so as to enable them to vibrate, and to adapt themselves to the curves and undulations of the road, by the combined action of the pins or pivots, the vibrating bars, with the box and the boxes, and plummer blocks of the axles, with their cylindrical fittings, the whole being constructed, combined, and arranged substantially in the manner herein set forth, the respective parts co-operating with each other, upon the principle, or in the manner above made known and described.

"I do not intend to claim, nor do I claim, either of the parts above described, taken separately or individually."

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18. For an *Improvement in Brakes for Railway Cars;* John R. Grout, Utica, New York, August 25.

Claim.—"Having thus fully described my machinery, and the manner of using it, what I claim as new therein, and desire to secure by letters patent, are the following, that is to say:

"I do not claim any one of the parts of the engine, tender, or car, separately and independently of the arrangements and combinations herein set forth and claimed, nor any combination, or combinations of parts not herein especially named and claimed as my invention and improvement. But I do claim as my invention and improvement, in the first place, the manner in which the momentum of the cars operates the brake of the tender, by means of the fixture upon the first car and the rocking shaft, jointed slide rod, and springs in the tender, the same being combined and operated substantially as hereinbefore described. Secondly, The particular manner in which the slide and lever in the car are arranged and operated as described; including in said claim, the manner in which the resistance of the tender operates the brake of the car, or cars in train, by means of the rod in the tender; and the slide lever, rods, springs, and rocking shaft in the car, the whole being combined and operating substantially as before described.

Thirdly, I claim the manner in which I combine and arrange the respective parts of the regulator: that is to say, I claim in combination the forked lever, attached to the rocking shaft, the sliding tube which plays upon the shaft, to which the lower ends of the arms of the regulator are attached; the wheel to which the upper ends of said arms are attached, which wheel, by its friction upon a friction plate or wheel, communicates the action of the arms of the regulator to the machinery beneath; by which arrangement, when the momentum of the train is suddenly diminished, the arms with their weights and the tube, may continue their motion, thereby preventing the rupturing of the apparatus, which would result from the attaching of the arms of the regulator to the shaft, as has heretofore been done.

"The mechanical arrangements all being the same, substantially as herein before described, or varying therefrom only in form, which, it will be evident to every one conversant with mechanics, may be done without an invention, or the introduction of any new principle."

19. For an *Improvement in Wheels, and Tyres of Wheels, for Rail Roads;* Thomas Banks, Manchester, England, August 25.

This improvement in the construction of wheels, and tyres of wheels, consists in placing, inserting, or applying a bar or bars of steel in a groove formed in the periphery of railway wheels, or tyres of wheels, such groove being suitably turned, or otherwise formed, to receive the steel bar, or bars.

Claim.—"I claim, therefore, as an improvement in the construction of wheels, or tyres for wheels, to be employed upon railways, placing, inserting, or applying a bar, or bars, of steel in a groove, turned or formed in the said wheels, or tyres, the steel part not being welded to or with the wheel, or tyre, but capable of being easily removed when worn and replaced by new steel.

"I would remark, that a modification of this invention may be made by substituting iron bars for steel in the tyre of those wheels, where the expense of the steel is not desirable."

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20. For an *Improvement in Ploughs;* Jairus F. Tefft, Amherst, Erie county, New York, August 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the mouldboard and shares of a plough, so that a share can be applied to either the upper or under side of the mouldboard, in the manner and for the purpose herein set forth.

"I also claim the inclination of the cutter and land side, so as to cut a rhomboidal furrow slice as above described."

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21. For an *Improvement in Lamps;* John Grannis, Oberlin, Loraine county, Ohio, August 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the forcing pump described in the foregoing specification, and its application in the construction and use of lard lamps."

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22. For an *Improvement in the Rotary Steam Engine;* Solomon M. Eby and David N. Phelps, Jefferson Township, Richland county, Ohio, August 26.

The patentees say,—"The nature of our invention consists in the peculiar construction of the engine by which a regular rotary motion of the wheel is produced, by the direct action of the steam to sliding heads of said wheel."

Claim.—"What we claim as our invention, and which we desire to secure by letters patent, is passing the steam through the revolving wheel and sliding piston, from one side to the other, causing the steam to act simultaneously against the end of the piston in passing the steam chambers in the fixed head, and against the flat side of the opposite end of the piston in passing through the interior of the cylinder, thus forcing out the piston from the wheel, and closing the joints between

the flat side and end of the sliding valve, and the surfaces of the wheel and cylinder, against which they are pressed by the steam, and thus turning the wheel and shaft by the expansive force of the steam, without the use of any packing at the afore-mentioned joints, or the application of other power, in the manner herein set forth, or in any other mode substantially the same."

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23. For an *Improvement in Manufacturing Hats;* Francis Degen, City of New York, August 31.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is attaching the former as above described, to a hatter's finishing bench, by means of the frame constructed and arranged in the manner and for the purpose of elevating the former above the bench, to enable the operator to turn the brim with the iron, without moving the hat, as above set forth."

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24. For an *Improvement in Trimming the Heads of Bolts;* Micah Rugg, Southington, Hartford county, Connecticut, August 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the hollow slide or punch, which receives and carries the bolt, in combination with the die for trimming the heads of bolts, as described."

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25. For an *Improvement in Utensils to be used with Cooking Stoves of various kinds;* Salmon C. Riley, City of New York, August 31.

Claim.—"Having thus fully described the use and nature of my improved utensils to be used with cooking stoves of that kind which have oval or elongated openings in their top plates; what I claim therein as new, and desire to secure by letters patent, is the manner of constructing and using the utensil, which I have denominated the *principal piece*, its construction being such as to enable it to receive the respective auxiliary utensils herein described, and to admit of the vapors arising from articles which are being cooked to descend and be carried off with the heated air and gases from the fire, in their passage to the pipe along the flue leading from the fire chamber thereto.

"I also claim the construction and use of the cooking utensils whether used with or without the principal piece, but being furnished with openings, through which the vapors may descend into the flue, below the upper plate of the stove, when they are used for cooking, and a cover is placed over them."

List of American Patents which issued in the month of May, 1847, *with Exemplifications, by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Cooking Stoves;* B. Morehouse and W. W. Willard, Syracuse, Onondaga county, New York, May 1.

Claim.—"What I claim as new, and desire to secure by letters pat-

ent, is the arrangement and combination of the side flues, the central return flue, and the flue space in front and at the top of the oven, with the fire chamber, the apertures, the valve, the space, and the discharge flue, substantially in the manner and for the purpose herein set forth."

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2. For an *Improvement in Water Wheels;* Uriah A. Boyden, Boston, Massachusetts, May 1.

The patentee says,—"The nature of my invention consists in causing the stream or streams of water from a water wheel, to diverge gradually, or in causing the water which is ejected from a water wheel, to be diffused gradually, whereby the momentum which the water has on leaving the water wheel, is expended in diminishing the pressure of the water or air on the parts of the wheel which the water last leaves, which is effected by applying a diverging or flaring passage, or passages, the water necessarily passes through after leaving the wheel, which causes the stream, or streams of water to expand, or spread gradually, or to be gradually diffused; and hence, I call this adjunct to the wheel, which I have invented, a *diffuser.*"

Claim.—"What I claim as my invention, and desire to secure by letters patent, is my diffuser as described above, as adapted and applied to all turbines, reacting, and all other water wheels to which the same is applicable, viz: those which receive the water between their peripheries and axis, and discharge the water at their outer or circumferential parts, whether these parts be cylindrical, conical, convex, concave, or of whatever other form. I do not confine my claim to the precise forms of my diffuser described above, but I extend it to all forms which are essentially the same, in which the parts are so shaped as to form a gradually diverging, or spreading passage, or passages, or in which the passage, or passages spread, diverged, or enlarged from the wheel, by degrees, or by small steps, or offsets, so as to cause the stream, or streams of water on or after leaving the wheel, to expand, spread, or be diffused gradually, or by small steps, or degrees, so as to expend a considerable portion of the momentum which the water has on leaving the wheel, in diminishing the pressure of the water, or atmosphere, on the circumference of the wheel, or parts of the wheel, from which the water is ejected."

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3. For an *Improvement in Cast Iron Plates for Covering Buildings;* Matthew Stewart, City of Philadelphia, Pennsylvania, May 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is forming the rectangular plates with rebated edges on opposite sides, flat on the upper side, or surface, and concave on the under surface, having two of the corners of each plate cut off parallel, causing the plates to combine, and unite, and form close joints, having broad bearings to rest on the sheathing, or laths, and a perforated protuberance, or knob, and a countersink in the same, to admit the shank and head of a screw back of the point of junction of the cut off corners of the plates, so that when a plate is required to be removed, it becomes only necessary to withdraw the screw, and slide the plate

back from beneath the contiguous plates, and it becomes separated therefrom as before described.

"I likewise claim the manner of constructing the triangular shaped plates, having the long sides turned down nearly at right angles to the face of the plate, and notched, and ribbed for the facility of interlocking their ends and securing them together against the gutter; the short sides being rebated in a similar manner to the above named rectangular plates, in order to be fitted under the same, and be combined therewith, as described and represented.

"I also claim constructing the ridge cap, like an angular roof, with a vertical plate projecting down from the apex, and perforated to admit bolts or screws, by which it is secured to the ridge pole—the sloped sides being made sufficiently wide to extend over the adjoining plates on either side of the ridge, as above described and represented."

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4. For an *Improvement in Broiling Apparatus;* Nathaniel Waterman, Boston, Suffolk county, Massachusetts, May 1.

Claim.—"I claim the combination with the double gridiron, or steak holder, of a case made to surround it on all sides but one; the said case being for the purpose of preventing the access of cold air to the back of the meat, or steak, while being cooked."

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5. For an *Improvement in Cheese Shelfs;* Augustus A. Severence, Cherry Valley, Ashtabula county, Ohio, May 1.

The patentee says,—"The nature of my invention consists in providing shelves which revolve upon an axle, and turn upon pivots, or gudgeons, whereby either side of the cheese may be exposed by the dairyman to the air and operation of curing."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of shelves with the revolving frame, substantially in the manner and for the purpose set forth."

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6. For an *Improvement in Cooking Stoves;* Elihu Walter, Syracuse, Onondaga county, New York, May 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the flues over and under the two ovens; that is, carrying the flue entirely around the oven, (a portion of the said flue being under the fire chamber,) and then dividing the flue around the oven in the manner described, the whole arrangement being as herein set forth."

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7. For an *Improvement in Car Wheels;* William V. Many, Albany, New York, May 1.

The patentee says,—"From the time that the value of railroad wheels with a chilled head and flanch was established, the difficulty of thus casting them has been recognized, for it was soon ascertained that the chill sets and cools the metal of the rim before the parts

which connect it with the hub, and these in cooling shrink, and necessarily break, or become so weak as to break when subjected to strain or jar. To obviate this, the hub was for a long time made in sections, termed the "split hub," to enable it to open and yield to the contraction of the spokes, arms, or other connexions between the hub and rim, but this construction is attended with serious objections, such as the want of strength in the hub, and the necessity of putting on wrought iron hoops or bands, to secure the segments together. These recognized objections to the split hub, have led to numerous improvements and suggestions, all more or less objectionable, for casting the wheel in a single piece by so forming the connexions between the hub and rim as to admit of contraction without breaking; but as all these require the metal, as it contracts, to bend, it obviously must be weakened. The object of my invention is to avoid all these objections to the split hub, and to the various modes which have been substituted therefore, and my invention consists simply in casting the whole wheel in a chill, by means of which all the parts are cooled at the same time, and without undue strain on any part; I am thus enabled to cast a wheel in one single piece, without the split hub, and so connect the rim and hub in any desired form, the plain disk, being in my estimation, the most simple and efficient."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is casting the wheels of railroad cars, or locomotives, with the chilled rim, by chilling the part, or parts, that form the connexion or connexions of the rib and hub, substantially as described, whether both surfaces of the wheel be chilled or only one as described, whereby a better wheel can be cast in one piece than by any other plan with which I am acquainted."

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8. For an *Improvement in Mariner's Compasses;* Hall Colby, Rochester, Monroe county, New York, May 1.

The patentee says,—"The nature of my invention consists in providing duplicate or triplicate needles, arranged on a line on the face of the card of the compass."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement, in a line, of duplicate, or triplicate magnetic needles upon the card of the mariner's compass, by which local, and other influences and attractions are overcome."

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9. For an *Improvement in Window Blinds;* Ebenezer Cate, Boston, Suffolk county, Massachusetts, May 1.

Claim.—"I claim as my invention the pressure, in combination with the folding blind and its frame, as constructed with wide grooves, and made to operate in connexion therewith, substantially as described."

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10. For an *Improvement in Rail Road Wheels;* Perry G. Gardiner, City of New York, May 1.

The patentee says,—"The nature of my invention consists in form-

ing wheels of two corrugated, crimped, or convoluted disks of metal, having exterior convexities united to a rim, or tire, by means of screw bolts drawing inwards their centres, and expanding the peripheries of the disks into grooves in the inner side of the rim."

Claim.—"What I claim as new, and desire to secure by letters patent, is the forming a wheel of two corrugated, crimped, or convoluted disks of metal with outward convexities, combined with a rim, or tire, by means of screw bolts, drawing inwards their centres, and expanding their peripheries into grooves in the rim, substantially in the manner herein set forth."

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11. For an *Improvement in Dressing Staves;* Isaac Judson, New Haven, Connecticut, May 1.

The patentee says,—"The nature of my invention and improvement consists in combining and arranging two revolving rings, or wheels, having cutters on their opposing surfaces, or sides next each other, for shaving the stave transversely on its inner and outer sides, producing a stave, the cross section of which is the segment of a circle; the diameter of which is to be greater than the diameters of the said rings, or wheels, (the curve of the stave being variable at pleasure, according to the sizes of the different kinds of casks for which the staves are intended,) by changing the position of the stationary guides, and feed rolls, and of the cutters on the parallel rings, or wheels, so as to change the angle of the position of the stave with the plane of the rings, or wheels, which forms the base of a right angled triangle, or section of a cone, and the axis of said wheels which forms the perpendicular of said right angled triangle, or the axis of a cone the straight line in which the stave moves towards the cutters, being the hypothenuse of the right angled triangle, or the inclined side of the cone, represented by a line which is made changeable at pleasure, in order to change the degree of curvature of the stave as stated—the angle of the side of the cone with its base being increased, when the degree of the curve of the stave is to be decreased, and when the angle of the cone is diminished, the degree of the curvature of the stave is increased.

"This principle of introducing a stave, or other piece of wood, obliquely betweeen two series of revolving cutters, at any required angle, with the planes of the wheels, or rings carrying the cutters, for the purpose of cutting the stave, or piece of wood transversely to the segment of any given circle corresponding with that of the intended cask, constitutes my principal invention, and improvement.

"The nature of the second improvement consists in a new arrangement of the two movable fluted, or grooved feed rolls, for driving the stave fast, or between the revolving rings, or wheels of cutters, said rolls being held together by a spring, or other means, so as not to give to the stave any specific direction, leaving it to be guided by stationary rests of short lengths, so as to accommodate the crooks and winds of the grain of the wood to the position of the cutters."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is—

"1st. The manner of arranging the wheel and ring of cutters, in parallel planes, forming a space between them for the introduction of the stave, to be dressed simultaneously on both sides—concave on one side, and convex on the other, and to any degree of curvature required, according to the position of the guides in relation to the cutters on the wheel, and ring, as herein set forth,—the stave or other piece of wood being introduced obliquely between the two series of revolving cutters at any required angle with the planes of the wheels, or rings, carrying the cutters, for the purpose of cutting the stave or piece of wood transversely to the segment of any given circle corresponding with that of the intended cask, or barrel, of which the stave is to form a part,—changeable at pleasure by changing the position of the stave,—the feed rollers being made to swing to the right and left in the arc of a circle, for the purpose of accommodating themselves to the irregular shapes of the pieces of wood to be dressed into staves."

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12. For an *Improvement in Bedsteads;* I. H. Latouraudais, Flint Hill, Rappahanock county, Virginia, May 1.

The patentee says,—"The nature of my invention consists in the division and jointing of the mattrass, its combination with the bedstead, and the apparatus for elevating a portion thereof, as herein described."

Claim.—"Having thus described my improved bedstead for the sick, I wish it to be understood that I do not claim making a jointed mattrass, either part of which can be elevated, as that has before been done; but what I do claim as my invention, and desire to secure by letters patent, is so combining the mattrass with the bedstead as to be slid forward to the foot, substantially in the manner and for the purpose described.

"I also claim dividing the lower part of the mattrass longitudinally, as described, so that either part can be elevated, and in combination therewith the frames below these parts.

"Lastly, I claim the presser for elevating the mattrass to the back, as above set forth."

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13. For an *Improvement in an Apparatus for Discharging Grain from Vessels;* John Pagin, Buffalo, Erie county, New York, May 8.

The patentee says,—"The nature of my invention consists in so combining and arranging a conveyor and elevator, with a boat and the driving power, as to elevate the grain from the hold of one vessel, and conveying it and delivering it into another, the elevator being connected with one end of the frame of the conveyor by a vertical slide, that it may descend as the quantity of grain in the hold of the vessel is reduced, and to admit of its being adapted to the various heights of vessels, the connexion with the driving power being made by means of a universal joint and sliding shaft, or other mechanical

equivalents—the other end of the conveyor being jointed to the framing, so as to render the whole apparatus self-adapting to the motions of the vessel, and boat, or scow, produced by swells or other causes."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is so combining a conveyor, and elevator, with a boat, or scow, and the driving power, that the elevator and the end of the conveyor, to which it is attached, can be moved up or down so as to be adjusted to the relative height of the vessel from which the grain is to be elevated, and the boat to which they are attached, and also to the varying height of the grain in the hold of the vessel from which it is to be raised, in the manner substantially as herein described."

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14. For an *Improvement in Ball and Socket Castors;* A. F. Ahrens, Philadelphia, Pennsylvania, May 8.

Claim.—"Having thus fully described my improvement, what I claim as my invention, and desire to secure by letters patent, is supporting the ball of a ball and socket castor, within the socket on points, substantially in the manner and for the purpose described."

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15. For an *Improvement in Dies for Cutting Screws;* Philetus M. Gates, Chicago, Cook county, Illinois, May 8.

The patentee says,—"The object of this improvement is to construct a die in such a manner as that it shall be capable of cutting a full and perfect thread, whether square, or with the sides meeting in an angular edge, at one operation, without the application of more power than is usually expended in each cut of the ordinary dies, which have to be passed several times along the cylindrical piece on which the thread is to be formed. My die is to be made in one piece of cast steel, and usually in the form of a rectangular block, of such diameter as may be necessary, according to the size of the screw to be cut, and of such thickness as may be required by the number of threads that should be formed within it; in most cases it may contain from six to eight threads, but in general six will be found sufficient. Within the hole made through this die for that purpose, a screw is to be cut, in the lathe, or by means of a screw tap. I then proceed to drill two, four, or any preferred number of small holes from one face to the other of the die, their axes coinciding with that of the axis of the large hole constituting the cutting part of the die; these holes are to form a portion of the throat for the receiving and escape of the chips that are to be cut off by the die; they may be from one-fourth to three-fourths of an inch in diameter, more or less, according to the size of the die; supposing the die to be square, they should be drilled towards the angular corners of the block, and their sides should just touch, or be in close contact with the larger diameter of the thread of the screw cut in the die. The portion of the die between these holes and the large hole with cutting theads, are to be filed away in a manner to be presently described. If the threads have been cut up in the lathe, a portion of them may be turned off in such manner as to leave one or

two of the threads that are towards the upper face of the die, perfect, but so that the remaining part shall form a hollow cone, the diameter of which on the opposite or lower face of the die will just obliterate the termination of the last thread; this lower end will then admit the end of the cylindrical piece on which a screw is to be cut; if the screw has been cut by means of a tap, the threads may be reduced by a file. The large hole containing the respective threads will thus increase in diameter, in passing from the upper to the lower face of the dies, and these threads are each to be formed into acute cutting edges, each of which will take off a shaving from the cylindrical piece, instead of in part bruising it into the form of a thread, or of merely scraping a portion away, as is ordinarily done. The parts of the threads not concerned in the cutting are to be further removed by filing."

Claim.—"Having thus fully described the manner in which I construct my dies for the cutting of screws upon metal, and shown the manner in which the same operates, what I claim as new, and desire to secure by letters patent, is the forming of such dies of one solid block, in such manner as that they shall cut a perfect screw by the once passing of it along the piece to be cut; this being effected in the manner set forth: that is to say, by the forming of acute cutting edges on the threads within the die, which threads are to be regulary reduced in height from the upper to the lower face thereof, at which part the last terminating thread is obliterated, and by the filing away of a large portion of threads. The cutting edges being also furnished with throats for the escape of the cuttings, as made known, and the whole apparatus being arranged, combined, and operating substantially in the manner and for the purpose set forth."

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16. For an *Improvement in Carriage Wheels;* Robert W. Thompson, Great Britain, May 8, (patented in England 21st of October 1846.)

The patentee says,—"The nature of my invention consists in the application of elastic bearings around the tires of the wheels of carriages for the purpose of lessening the power required to draw the carriages; rendering their motion easier, and diminishing the noise they make when in motion. I prefer employing for the purpose, a hollow belt composed of some air and water tight material, such as sulphurized caoutchouc or gutta percha, and inflating it with air, whereby the wheels, will in every part of their revolution, present a cushion of air to the ground, or rail, or track, on which they run."

Claim.—"What I claim is, first: the application of elastic bearings round the tire of carriage wheels, as before described; and secondly: the application of similar elastic bearings to the surfaces of other rolling bodies, as before exemplified."

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17. For an *Improvement in Syphons;* Asahel Aldrich, Douglass, Worcester county, Massachusetts, May 8.

Claim.—"What I claim as new, and desire to secure by letters patent, is the combining of the syphon with a closed receiver, in such

manner as that said receiver shall constitute an enlargement of the syphon at the height to which the tower is to be raised; the lower and shorter legs of the syphon being so proportioned to each other, as that the latter shall be capable of receiving within it a column of air from the closed receiver equal in volume to that which has been drawn therefrom, for the purpose and in the manner described; whilst said longer leg shall still contain a column of water more than sufficient to counterbalance the length of the column in the shorter leg; under which arrangement said column of air is discharged, and the closed receiver refilled preparatory to another intermission of the syphon for the discharge of water therefrom; and in combination therewith, the causing of the water which escapes from the closed receivers, operating by its gravity, to open and close the respective valves at the requisite periods for continuing the action of the apparatus; the whole arrangement and combination being the same in substance with that herein set forth. It is to be understood, however, that I do not intend by the foregoing claim, to limit myself in the construction of this apparatus to the precise form of the respective parts as herein described, but to vary these as I may think proper, whilst the principle of action, and the useful result thereby attained, remain in substance, unchanged."

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18. For an *Improvement in Wringing Clothes;* Ira Avery, Tunkhannock, Wyoming county, Pennsylvania, May 8.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of each end of the sack to conical heads of equal size by means of rings, for the purpose of enabling the sack to adjust itself perfectly to the heads, thereby preventing unequal strain and rupture of any portion thereof; one of the said conical heads being stationary and the other being connected to an axle, and operating crank, or handle, substantially as herein set forth."

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19. For an *Improvement in Carriages;* John S. Royce, Leicester, Livingston county, New York, May 8.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of stiffening and supporting the felloe of the wheels, securing the same to the tire, and firmly fastening the conical heads of the spokes in the countersinks in the tire by means of the screw nuts (working on screws on the spokes) substantially in the manner herein set forth.

"I also claim the constructing the pipe skeins with loops, on their inner ends, and the connecting the same with the perch, and with the shafts, or pole, substantially in the manner and for the purpose herein set forth."

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20. For an *Improvement in Window Blinds;* Ebenezer Cate, Boston, Suffolk county, Massachusetts, May 8.

The patentee says,—"By my invention the folding shutter is not

only made to answer the purpose of effectually closing the window, and excluding the light, thieves, &c., but may be used, or opened, to admit air, or light, in a manner similar to that in which a Venetian blind is usually opened."

Claim.—"What I claim as my invention is the two hinged chain bearing, and guide plates, in combination with each slat of the blind, having journals as described, the said plates being conjoined and made to move in grooves in the window frame, and applied to the slat, and operated in all respects substantially as specified."

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21. For an *Improvement in Lynch Pins, and Washers;* Warren Mansfield, South Braintree, Massachusetts; and H. L. Thistle, City of Washington, D. C., May 8.

Claim.—"What we claim as new, and desire to secure by letters patent, is the attaching of the washer and lynch pin, by means of a chain, to a swivelling ring on the hub of the wheel, the attachment being made in the manner set forth, so that for the removal of the lynch pin, said washer will have to be turned round in the manner described, the whole combination and arrangement being substantially the same with that herein fully made known."

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22. For an *Improvement in the Manufacture of Cigars;* Samuel E. Hartwell, and W. M. and Dégrasse Fowler, of the City of New York, May 8.

The patentees say,—"The nature of our invention consists in forming the filling of cigars, and covering them with a wrapper by machinery, by which the process is facilitated, and greater perfection is attained in forming the cigar, while fine cut, or other tobacco, can be used for the fillers without waste."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the employment of a flexible apron, substantially in the manner described, for rolling the fillers of cigars into form, and covering them with the wrapper as herein set forth.

"We also claim forming the edges of said belt of elastic material, for shaping the taper at the ends of cigars.

"We also claim the employment of the roller and weight with the apron for maintaining the tension of the apron, and determining the pressure upon the cigar.

"We also claim, in combination with the above, the movable trough, formed of a series of belts, for receiving the filling, and carrying it forward as above specified, and the cutter and follower for cutting off the cigar, and carrying it into the bight of the apron as herein described."

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23. For an *Improvement in the Scarificator;* Frederick Leypoldt, City of Philadelphia, Pennsylvania, May 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the tumbler, and main spring,

substantially as herein described; the main spring having a ketch, and the tumbler a shoulder, or step, and pin; these parts being arranged, and operating in the manner and for the purposes described."

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24. For an *Improvement in Rail Road Wheels;* Anson Atwood, Rensselaar county, New York, May 15.

The patentee says,—"The object of my invention is to cast a wheel in one piece with a solid hub, without subjecting the parts to the liability of breaking; and the nature of my improvement for this purpose, consists in connecting the rim with a ring whose faces are made in radial waves, passing around by a series of curves from one edge of the rim to the other entirely around, to give a continuous support to the whole width of the rim, and chiefly to yield without strain on the metal, to the contraction of the ring which cools after the rim; this mode of connecting the rim and ring, being combined with a solid hub, by means of a dished flanch, or flanches, which admit of yielding to the contraction of the metal in the direction of the radii."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is connecting the rim of the wheel cast in one piece with a solid hub, by the combination of a ring made of radial waves, in combination with the dished flanch, or flanches of the hub, which form a rim concentric with the rim of the wheel, substantially as described; whereby the several parts can yield to the unequal contraction in all directions without serious strain of the metal as described."

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25. For an *Improvement in Stoves;* Garrettson Smith, and Henry Brown, Philadelphia, Pennsylvania, May 15.

The patentees say,—"The nature of this invention consists in placing in the fire chamber immediately in front of the oven, a series of inclined ribbed flue plates, composed of cast iron, or other suitable material, for the purpose of directing the draught in any direction required, and preventing the lower flues from being obstructed by ashes, or other particles, arising from the fire."

Claim.—"What we claim as new, and desire to secure by letters patent, is the flue plates, and cylinder, constructed substantially as described."

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26. For an *Improvement in Hot Air Furnaces;* David Culver, Hartford, Hartford county, Connecticut, May 15.

The patentee says,—"The object of my invention is to obtain a large radiating surface, with the view to get the greatest amount of heat with a given amount of fuel, and so to arrange the parts that the inside may be kept clear of soot and ashes during the operation of the furnace; and the nature of my invention consists in making the drum, placed immediately over the fire, in the form of an hour glass, surrounded with a series of pipes, the lower ends of which open into a chamber, formed by an inverted hollow frustrum of a cone that forms

the connexion between the fire pot and the drum, and their upper ends opening into a dome that extends over them and the drum. And my invention consists, also, in a disk valve, or swinging partition in the smallest part of the drum, the valve being properly balanced and hung on journals, and provided with a weight attached vertically to its underside, to act like a pendulum, or provided with any other means by which to keep it closed, except when vibrated, to discharge the soot and ashes which may accumulate on its upper surface. By this arrangement of parts, the products of combustion in rising from the fire pot, impinge on the curved surface of the drum, (which, as stated above, is formed like an hour glass, to present a large surface,) and against the valve, (which is kept closed by the pendulous weight,) and finding no escape they are deflected, and pass up the vertical pipes into the upper part of the drum, and dome, which they heat, depositing the soot and ashes on to the valve, or swinging partition, and then pass through a horizontal pipe into one division of a flat radiator down to the base thereof, and thence up the other division, and out into the exit pipe, the arrangement of this flat radiator, in combination with the circular radiator, constituting the third part of my invention. And the last part of my invention consists in uniting the horizontal and escape pipe with the top of the flat radiator, by means of a globe or sphere, in combination with a round disk valve, by means of which spherical enlargement and disk valve, the aperture for the passage of the products of combustion, is always of the full capacity of the pipe."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the drum which is placed over the fire pot, in the form of an hour glass, to present a large amount of surface to the action of the flame, and for radiation, as described, when this is combined with the vertical pipes surrounding the drum as described.

"I claim the employment of the disk valve, or swinging partition within a vertical drum, placed over the fire for the discharge of soot and ashes from the compartment above the swinging partition, as described.

"And finally, I claim the globe-formed enlargement at the junction of the pipes, and the flat radiator, in combination with the circular disk valve, or damper, by means of which enlargement, in combination, the apertures for the passage of smoke, &c., are retained of their full capacity."

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27. For an *Improvement in Ship's Windlasses;* Albert Russell, and E. R. Walker, Newburyport, Essex county, Massachusetts, May 15.

The patentees say,—"We are well aware that a nipper purchase and a pall purchase, have been used separately on windlasses, therefore we make no claim to them when used separately, but that which we *claim* as our invention, is the *combination* of the nipper and pall purchases, in the manner substantially as specified."

28. For an *Improvement in Hand Drills;* Amos Morgan, Masselon, Stark county, Ohio, May 15.

The patentee says,—"The nature of my invention consists in constructing a cheap hand drill for iron and other metals, so as to be made self feeding, and at the same time being readily fed by hand without stopping the other feed."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the mandril with the feeding apparatus, in the manner described, by means of the hollow screw, and case, surrounding the mandril, connected with the ratchet, and dog, substantially in the manner set forth."

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29. For an *Improvement in Bedstead Fastenings;* J. W. Moyer, Utica, Oneida county, New York, May 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of fastening bedsteads above described, in making the back face of the spurs which secure the tenons in their mortises, partly diagonal, and partly parallel with the front face thereof, and the shoulder of the tenons, substantially as described, when this is combined with the grooves in the sides of the mortise, and the sockets formed by, and for the reception of the spurs, as described; whereby the rails and posts of square tenon bedsteads can be fastened at less expense, and held together more firmly than by any other plan known to me."

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30. For an *Improvement in Furnaces for Heating Buildings;* Wm. Hickok, City of New York, May 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the vaporizer with the air heater, constructed, and operated in the manner and for the purpose set forth."

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31. For an *Improvement in Rakes;* Charles Carlisle, Norwich, Windsor county, Vermont, May 15.

Claim.—"What I claim as my invention is the combination of a balance box, or weight, with the shafts and axletree, for the purpose described. I also claim the mode of supporting the rake head and confining it to the axletree, viz: by the springs and jointed rods acting substantially in manner and for the objects specified."

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32. For an *Improvement in Suspender Buckles;* Julius Hotchkiss, Waterbury, New Haven county, Connecticut, May 15, (antedated, Dec. 22, 1846.)

The patentee says,—"The nature of my invention consists in attaching with an eyelet, or rivet, a leather loop to a suspender buckle, and particularly the manner of its connexion, so as to form a joint,

or swivel, operating in its use and application, conformable to the particular wants of such an article."

Claim.—"I claim securing the leather strap, or loop, to the suspender buckle, in the manner described, by means of the eyelet, or rivet, whereby I obtain a durable and cheap mode of fastening, at the same time with a durable and serviceable swivel joint."

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33. For an *Improvement in Dentists' Drill;* John and Dayton S. Kellogg, assignees of L. D. Walter, Fort Plain, Montgomery county, New York, May 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the main spring, pulley, and cord, with the drill, for the purpose of drilling, countersinking, trepanning, &c., substantially as described."

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34. For an *Improvement in Smut Machines;* James E. Wratten, Rush, Monroe county, New York, May 15.

Claim.—"What I particularly claim as my invention, is the mode of making the rubber, substantially as above described—that is to say, covering the external convex surface of the frustrum of a cone with sheet iron rings, of trapezoidal shaped teeth, combined and arranged, and operating in the manner and for the purpose set forth."

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35. For an *Improvement in Spark Extinguishers;* Samuel Gibson, Manayunk, Philadelphia county, Pennsylvania, May 22.

The patentee says,—"The operation of the machine is as follows: When the engine is set in motion, the steam, by acting on the fans at the bottom of the inner pipe, gives a rapid revolving motion to the shaft carrying the inner pipe, and then passing with the smoke, &c. into the spiral flue formed by the inner pipe, and spiral planes, keeps up and increases that motion issuing out of the top of the inner pipe, from whence the smoke and cinders are thrown with violence against the inside of the outer pipe, or its cap, and then falling down on the partition plate, are discharged by the oblique pipe downwards upon the road. When the apparatus is not in operation, the smoke is discharged by a pipe of the ordinary construction, made to open and close with a valve at the bottom of it, placed behind the triple pipe, or spark catcher; the valve is managed by a crank and rod, passing to the hand of the engineer."

Claim.—"What I claim as my invention, is the combination of the triple pipe, and the revolving screw, and in combination therewith, the oblique partition plate, and discharge pipe."

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36. For an *Improvement in Door Springs;* Thomas Peck, Syracuse, Onondaga county, New York, May 22.

Claim.—"What I claim as new, and desire to secure by letters patent, is the spring, the roller, and the cam, on the periphery of the

drum, combined and operating with each other, and with the spring, lever, and roller, substantially in the manner and for the purpose herein set forth."

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37. For an *Improvement in Cooking Stoves;* Ashley Crafts, Auburn, Geauga county, Ohio, May 22.

The patentee says,—"The nature of my invention consists in constructing a stove which can be used as a small cooking stove. If a larger one is required, the stove part may be drawn out from under the oven, which gives two additional boiler holes. If a fire place or open stove is desired, it is effected by running the stove part under the oven, and raising the jambs to their elevated position."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st. Making the stove sides continuous with the hearth and flue plates, both top and bottom, in combination with the sliding jambs, which keeps all fire or ashes from dropping through when the jambs slide up or down outside of them.

"2d. The method by which the jambs, and front, top, and other plates of the stove are fastened together, which is by four loops, two of which are cast on each end of the top, and the two pins which are cast on to each jamb, all on the inner and under side of each piece. The pins lock into the loops and make all fast without the use of bolts or rods.

3d. The manner of using the lever in combination with the movable jambs, by which the stove is changed from a cook stove to a fire place.

4th. Arrangement in the front oven plate of an aperture or chimney flue, which flue constitutes the draft when it is used as a fire place.

5th. The moving the stove back to bring the back side of the front top to meet the chimney flue in the front oven plate, when raised into a fire place."

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38. For an *Improvement in Car Wheels;* Asa Whitney, Philadelphia, Pennsylvania, May 22.

The patentee says,—"The design of my improvement is to give a greater degree of elasticity, than has heretofore been given, to the wheels used on rail roads, and to provide more perfectly for their ready expansion and contraction in virtue of such elasticity; and that whether said wheels are made entirely of cast iron, or of a combination of cast and wrought iron, or other metal, my improved wheels are of the kind in which the space between the rim, and the hub, or nave, consists of a disk, or disks, instead of the spokes that have been most generally employed. These disks I make corrugated in such manner as that a vertical section cutting them through their centres, and also a like division of them into circles at any point between their rims and naves, would present waved, curved, or sinuous lines, which may be either of continuous curves, or of straight lines and angles,—said wheels being corrugated in one or more forms, or in any form in which both the transverse and circular sections above named

would produce such sinuous, or waved lines. I am aware that car wheels have been made with disks that were concavo-convex, both double and single, and that they have also been made with disks, the transverse section of which, from the rim to the hub, would present a waved line, consisting of two or more curves; but neither of these forms fulfil the condition of allowing a free expansion and contraction in all directions, resulting from the elasticity consequent on the manner of corrugating them."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the corrugating of the disks of rail road wheels in such manner as that they are rendered elastic and flexible, and are susceptible of expansion and contraction, by the yielding of the corrugated parts, both in diameter and circumference simultaneously."

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39. For an *Improvement in Cast Iron Car Wheels;* Asa Whitney, Philadelphia, Pennsylvania, May 22.

The patentee says,—"The design of my improvement is to give a greater degree of strength, with a less amount of material, than has heretofore been given to the wheels used on rail roads, which is accomplished by making the disk, or that part of the wheel between the rim, or hub, or nave, corrugated in radii from the centre, so that a vertical section around the centre, at any point between the rim and hub, will show a waving, or wrinkled line, which may be either in continuous curves, or in straight lines and angles, while a vertical section across the wheel through its centre, would present a straight line on the disk."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner set forth of corrugating the disks of rail road wheels, by which they can be made stronger and more durable with a less amount of material, than any other form of disk, or spoke wheels, as heretofore made."

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40. For an *Improvement in Making Brick;* Alfred Hall, Coxsackie, Green county, New York, May 22.

The patentee says,—"The nature of my invention consists in a peculiar construction of machinery, to be worked by hand and horse power, for producing in an expeditious and efficient manner, bricks, tiles, and other articles from earthy or plastic materials. The moulding machine I propose to place in direct communication with the pug mill, in order to keep up a regular and continuous supply of clay to the moulds."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the press with the pug mill, as above set forth, so that while the clay is being pressed into the mould, it shall, at all times, have a free opening into the mill, by which much of the danger of breaking the parts is avoided. I also claim the curved railway in combination with the movable carriage for forcing in the moulds, so that said carriage shall have its front at the same level at all times.

"Lastly, I claim the method of constructing the press so that the side plates do not require to be made with a slot in them, by carrying the shaft that connects the press with the segments back, so as to be free to act as herein specified, without passing below the point the press plate moves back to."

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41. For an *Improvement in Steam Engine Valves;* Jas. A. Stevens, (assignee of Sprague Barber,) Hoboken, New Jersey, May 22.

The patentee says,—"The object of this invention is to construct a less expensive and more perfect apparatus, for closing the steam valves at different portions of the stroke of the piston, and thereby cutting off the steam from the boiler, and allowing it to act expansively in the cylinder. This I mean to accomplish by what I call a drop slide, this drop slide elevates the valve to its required height with the original lifting rod, by means of its shoulder, and then the shoulder being withdrawn by an attachment to some suitable portion of the machinery, allows the valve to drop with any degree of velocity that may be found necessary on the curve of the drop slide."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method herein described, of connecting the lifter of the valve with, and disconnecting it from the lifter of the lifting rod, by means of the drop slide, in combination with the lifting rod and lifter attached to the valve, the drop slide being operated during the lifting of the valve, substantially as described; and I also claim the method of arresting the downward motion of the valve, by the inclined or curved face of the slide that holds and liberates the valve, whether it be the slide herein ascribed, or any thing analogous, or equivalent thereto, as described."

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42. For an *Improvement in Ploughs, or Cultivators;* Richard J. Gatling, Murfreesboro, Hartford county, North Carolina, May 29.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is,—1st. Making the cultivator with adjustable sliding wings of a rhomboidal form in their cross sections, arranged and operating in the manner and for the purpose described. 2d. Extending the rear or wide portions of the double share back, in the form of two flat curved wings, forming the curved spaces, and to which the side bars or braces are attached, and upon which the adjustable wings or mould boards are placed in the manner and for the purpose set forth.

"3d. Making the point in the form of a double wedge with wings, or shoulders, to fit into corresponding mortises in the share for securing the same—being reversible at pleasure as the point wears, susceptible of four changes."

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43. For an *Improvement in the Reduction of Iron Ores;* William S. Cooke, East Fairfield, Columbiana county, Ohio, May 29.

The patentee says,—"The nature of my invention consists in using steam in the form of a blast, for the purpose of softening iron, by in-

troducing a jet of steam into a cupola, or furnace of the proper temperature, (about 300° deg.,) either with or without air, depending on the kind of fuel used; the oxygen is absorbed by the fuel and supports combustion, and the hydrogen passes over the heated metal, the carbon of the metal unites with it, and is burnt in the form of carburetted hydrogen gas—by this process, hard brittle metal can be reduced to a soft malleable state even without melting; if the casting is too brittle, the steam may be thrown on it while heated to a white heat, and it will have the desired effect."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use and utility of using steam in the form of a blast, for the purpose of softening metallic ores while in the process of reduction (or changing form by smelting) as herein described."

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44. For an *Improvement in Grain Rakes;* John M. and B. B. Brown, Marits P. O., Marion county, Ohio, May 29.

The patentees say,—"What we claim as our invention and desire to secure by letters patent, are the combinations of the divider (operating as set forth) with the small frame in the manner described, also the sharp edges of the fore part of the fingers, by means of which the small vines and grass in the stubble are cut and prevented from obstructing the progress of the rake."

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45. For an *Improvement in Distilling;* George Riley, City of New York, May 29.

The patentee says,—"The nature of my invention consists in causing the 'wash' or other article to be distilled, to percolate down through a vessel filled with porous material, meeting an ascending current of steam by which all the volatile spirits are released and pass off through the worm of the still, the wash being made to constantly run off below."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is distilling alcohols and other volatile spirits, by causing a current of steam to pass up through a vessel filled with stones or other substance, as above mentioned, through which the wash or other material is percolating—the apparatus therefor being constructed substantially in the manner described."

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46. For an *Improvement in Jointing Staves;* A. H. Pinney, Columbus, Franklin county, Ohio, May 29.

The patentee says,—"The nature of my invention consists in the frame for applying a bent stave to two revolving planing wheels so as to joint both edges of the stave before it leaves the frame, and the apparatus for springing in and releasing the stave therefrom."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of an apparatus for applying the stave to the rotary jointing wheels, substantially in the manner and for the purpose set forth, so that the staves can be easily handled be-

yond the periphery of the wheels, and thrown accurately into place against them, as above specified.

"I also claim, in combination therewith, the manner of holding the block and springing in the stave as herein specified."

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47. For an *Improvement in Cotton Presses;* Riley Smith, Towanda, Bradford county, Pennsylvania, May 29

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of arranging and combining the weights with each other and with the levers, so as to cause said weights to co-operate in sustaining the levers and to cause their joint action when required, as set forth."

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48. For an *Improvement in Distilling;* William H. Bayless, City of New York, May 29.

The patentee says,—"The nature of my invention consists in forming and arranging the vessels or receivers, designed to contain the article to be evaporated, distilled, or condensed, so that the heat of the steam or vapor arising from a boiler, arranged in the common furnace, shall be made to act against the bottom or sides of a vessel composed of some good conductor of heat, such as copper, containing a liquid or other solution to be evaporated or distilled—the heat of the vapor or steam arising from said liquid in said vessel, being in turn made to act against the bottom or sides of a second similar vessel, containing a similar liquid, or solution; and so on to any required number of vessels, placed or arranged, one above another, or in any convenient way, in a tight case, or room, or other suitable structure, made of an oblong or round, or other figure, or shape, of some good non-conducting material, such as brick, or wood, a communication being opened from one vessel to another throughout the whole series, by means of vertical pipes, open at both ends, passing through the bottoms of said vessels, the upper ends of said pipes or tubes, being a little below the upper edges, or the level of the tops of the vessels, or evaporators, so that when the upper vessel is filled nearly to the top level (which is effected by the pipe leading from the vessel or reservoir containing the article to be evaporated), the liquid will commence running from the top vessel into the next below it, and so on, passing through the several connecting pipes, until all the vessels and boilers are filled to the required levels at which they are kept, by keeping up this supply through the pipe; the bottoms of the several evaporators being made inclining at any suitable angle, for the purpose of discharging the condensed vapor into suitable receivers placed below them, provided with suitable pipes, passing through the walls of the case for conveying the condensed vapor wherever desired."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the before described mode of evaporating and distilling by means of a series of vessels so formed and arranged in a non-conducting structure as to transmit the heat arising from the vapor or steam of a common boiler to the under surface or sides, of a

series of boilers in succession, by which the heat, which is usually lost, is made to produce a repetition of the evaporating operation to the bottom or sides of an extra number of boilers to any degree required, by which a great saving in the cost of fuel is effected in the process of evaporation or distillation, the steam or vapor being condensed and collected in vessels in the interior of the external non-conducting case, as fully shown in the specification."

MECHANICS, PHYSICS, AND CHEMISTRY.

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculation of Steam Engines. *By* M. V. REGNAULT.

FOURTH MEMOIR.

(Continued from page 55.)

PART SECOND. *Of the Mercurial Thermometer.*

"The mercurial thermometer not being a comparable instrument beyond the temperatures which have served to determine the fixed points of its scale, it is evident that it ought not to be employed in precise experiments to measure high temperatures, but that recourse ought to be had to the air thermometer. But the employment of this latter instrument is much more difficult; it requires very delicate manipulations, and circumstances may present themselves in which the air thermometer is completely inapplicable, as, for example, when it is necessary to determine the temperatures in very confined spaces; the mercurial thermometer must then necessarily be used, but it will be proper, in the first place, to make a direct comparison of this instrument with an air thermometer, so as to transform its indications into those of the standard thermometer."

"Dulong and Petit were the first who made a comparison of the air with the mercurial thermometer from $-36°$ to $+360°$ ($33°$ to $+680°$ Fahr.,) and they calculated a table by which the indications of the one can be transformed into those of the other."

But the table of Dulong and Petit is necessarily inexact even for the particular mercurial thermometers which they employed, since their experiments were calculated with a coefficient of dilatation of air, much too great. M. Regnault also made a great number of experiments upon this subject—*(Annales de Chimie et de Physique, 3^e serie, tome V., p.* 83,*)* and in the course of these experiments, he found that mercurial thermometers were not comparable, so that the table published in his memoir, applies only to the particular thermometers which he employed. M. Magnus also investigated the same subject nearly at the same time. *(Annales de Chimie, 3^e serie, tom. VI., p.* 353.*)* The numbers which he gives, differ from those of M. Regnault, which ought not to surprise us, since the glasses used by the two experimenters, were of very different composition. (See note to M. Magnus' memoir, *Annales de Chimie, tom. VI., p.* 370.) But since the cause of these differences is evidently the different dilata-

tions of specimens of glass varying in composition, it remains yet to be seen whether mercurial thermometers constructed with the same kind of glass, although made in different ways, would not accord sufficiently in their movements to allow them to be considered as comparable. If this be the fact, it will be enough to compare one of these thermometers once for all with the air thermometer, and to admit the same table of corrections for all similar instruments. It was in order to decide this question, that M. Regnault undertook the series of experiments recorded in this part of his memoir; which experiments, he extended not only to the comparisons with the air thermometer, of thermometers made of the same kind of glass differently worked, but also to a similar study of instruments made of all the various kinds of glass found in the commerce of France, and used in the formation of physical apparatus. By this means he put himself in possession of a table of cubic dilatations of various kinds of glass at different temperatures, which table was absolutely necessary in his experiments, for the purpose of rigorously correcting the air thermometers for the dilatation of their envelopes, and which we insert in this brief digest, in consequence of its importance in many physical investigations.

The mercurial thermometers used by M. Regnault in these experiments, were not of the ordinary construction, but were overflow thermometers, *(thermomètres á déversement,)* which are more easily constructed than the ordinary thermometers with graduated stems, and present, moreover, the very great advantage of permitting the whole mercurial column to be easily kept in the bath whose temperature is to be noted, while with the common thermometer, a notable portion of the stem rises above the heated bath, and must be allowed for by a correction, the elements of which are always very uncertain.

Overflow thermometers consist of reservoirs of glass, terminated by capillary stems, drawn out at their extremities, and recurved. The mercury in these instruments is boiled frequently and with great care, and the instrument is then immersed in ice with its beak plunged into a vessel of mercury. When the thermometer has taken exactly the temperature of 0°, (which is easily determined, because if the capsule be removed, the mercurial column remains stationary at the mouth of the capillary tube,) the ice is removed, and the mercury which is discharged by the elevation of temperature, is collected in a small capsule. This is then weighed together with the apparatus filled with mercury; and if from the sum of these weights, we subtract the weight of the empty thermometer, we shall have the weight of mercury which fills the apparatus at 0°. Call this weight, *P*.

Now expose the apparatus to the temperature of boiling water, (which temperature may be determined from the height of the barometer at the time, by the use of the table given by M. Regnault, *(Annales de Chimie et de Physique, 3^e serie, tome IV., p. 206,)* or the proper precautions may be used to make it exactly 100°. Call this temperature θ, and let the weight of mercury discharged between 0° and θ be called π. Whenever the same instrument, after refilling, is carried to any unknown temperature t, the weight of mercury discharged

being p; this temperature will be given *in degrees centigrade*, by the formula $$t=\theta\,\frac{P}{\pi}\,\frac{P-\pi}{P-p}.$$

Or since θ, P, and π are constants for the same instrument, calling $\theta\frac{P-\pi}{\pi}=A$ we shall have the formula $t=A\frac{P}{P-p}$.

And M. Regnault proceeds to demonstrate that this temperature will be the same as that shown under the same circumstances by an ordinary mercurial thermometer, with graduated stem, whose envelope is formed of the same material, and by the same mode of working, as that of the overflow thermometer.

The first experiments upon this subject by M. Regnault, were made upon thermometers made in different ways from the crystal glass of Choisy le Roi. This glass is made of extremely pure materials, the proportions of which are determined with extreme care; it presents, therefore, the same composition, and is very valuable for experimental purposes on this account.

The first thermometer of this glass had its reservoir formed of a tube of 14 mm. interior diameter; and the stem was made of a capillary tube of the same glass welded upon the reservoir.

The second thermometer had a spherical reservoir obtained by blowing from a capillary tube.

The third thermometer was formed from the same capillary tube as No. 2, which was worked in the lamp so as to form a cylindrical reservoir, of about 12 mm. diameter, and from 12 to 14 cm. in height. To obtain this the glass had to be submitted a number of times to the flame, and it was therefore well fitted to show whether a long working of the glass had any influence upon the law of its dilatation.

A fourth thermometer had a reservoir made of a small globe of 50 mm. in external diameter, the walls of which were from 3 to 4 mm. in thickness, it was used to study the effect which different thicknesses of glass would have on the results.

The analyses of the reservoirs of these thermometers by M. Salvetat, a young chemist, attached to the royal manufactory of porcelain at Sevres, gave the following results:

	Silica.	Alumina.	Oxide Iron.	Oxide Manganese	Lime.	Potassa.	Soda.	Oxide Lead.
No. 1, Mean of 3 experiments.	54·16	0 52	trace	trace	0·36	9·23	0·90	34·62
" 2, " 5 "	53·83	0 49	0·24	0·24	0·78	7·98	2·54	34·08
" 3, " 5 "	54·39	0·43	0·33	0·19	0·69	7·80	2·40	33·70
" 4, " "	53·32	0 48	trace	trace	0·40	9·16	0·95	35·38

The result of these experiments was to shew that although the coefficients of dilatation of these different glasses differed notably, as will be seen by the following table:

Dilatation of the glass of No. 1, from 0° to 100°=0·002144
" " " " 2, " " 0·002442
" " " " 3, " " 0·002328
" " " " 4, " " 0·002270

yet, that the law of the increment of the dilatation was the same within the limit of errors of observation; whence we may conclude that the same corrections may be applied to reduce the indications of any thermometers made of this kind of glass to those of the air thermometer.

M. Regnault then proceeds to give his experiments upon thermometers made of other kinds of glass, viz: various specimens of common glass, the green glass of difficult fusibility used in chemical experiments, and a specimen of Swedish glass possessing the same physical characters. The analyses of these glasses gave the following results:

Thermometer.	Density	Silica.	Alumina.	Oxide Iron.	Oxide Manganese.	Lime.	Magnesia.	Potassa	Soda.	Oxide Lead.
No. 5, Common glass	2·455	70·48	0·46	0·28	0·19	8·75	0	2·14	17·20	0
6, " "	2·452	69·75	0 75	0·67	0 50	8·59	trace	2·60	16·30	0
7, " "	2 606	70 95	1·00	2·00	1 00	5·74	trace	5 67	10·41	3·16
8, " "	2·449	72 56	1·95	trace	trace	7·26	trace	2·97	14·86	0
9, " "	2·447	72 31	0·96	0 29	trace	5·88	0	4·18	15·29	0
10, Chemical "	2·481	68·58	1·23	1 84	0·46	4·07	0	2 00	12·00	0
11, Swedish "	2·410	71·37	0·33	trace	trace	9·36	trace	17·23	1·79	0

The thermometer No. 5, was formed from a tube of 12 or 14 mm. interior diameter, and 1 mm. thickness.

No. 6, of a tube similar to No. 5, but of about double the thickness.

No. 7, of a small globe welded to a capillary stem of the same material.

Nos. 8, and 9, of bulbs blown upon capillary stems in the ordinary way.

No. 10, of a tube similar to those used for organic analysis, soldered to a capillary stem of the same.

No. 11, of a similar tube, brought by M. Pelouze from Sweden in 1840, and remarkable for its infusibility.

The dilatations of these glasses from 0° to 100° were as follows:
No. 5, 0·002713. No. 7, 0·002431. No. 9, 0·002758. No. 11, 0·002492.
" 6, 0·002686. " 8, 0·002619. " 10, 0·002324.

Besides these experiments, the memoir contains the corrected results of other experiments of the author made in 1841, and reported in the *Annales de Chimie et de Physique, 3e serie, tome V., p.* 83, (which required correction, owing to the new determination of the absolute dilatation of mercury,) as well as a series of comparisons between the mercurial and air thermometers in the vapors of boiling oil of turpentine and of mercury.

The general conclusions from all these experiments, we give in the words of the author:

" *Mercurial thermometers made of the different kinds of common glass, which are now ordinarily used in the manufacture of chemical implements, do not move rigorously together beyond the fixed points which have served to regulate their scales; but the differences are so small, that they may be neglected in the greater number of experiments, especially if we take care to reject those glasses which contain a perceptible quantity of oxide of lead, which are easily recognized while working them in the lamp.*"

"Mercurial thermometers of ordinary glass, differ considerably in their indications from those whose envelope is of crystal; and these two classes of instruments cannot be considered as comparable."

"In all cases, it is necessary to transform the indications of mercurial thermometers into those of the air thermometers, by means of the tables which we give farther on."

"I inquired whether the absolute dilatations (k_t) of the same glass envelope, and the apparent dilatations (Δ_t) of the mercury in this envelope, could be connected with the temperatures (T) given by the air thermometer, with sufficient exactness, by parabolic formulæ of two terms; $k_t = bT + cT^2$. $\Delta_t = b'T + c'T^2$. But I found that these formulæ did not represent the observations in a satisfactory manner. When, therefore, it is necessary to know with great accuracy the values of these dilatations, it is better to deduce them by graphic constructions made from the immediate data of experiments, or to calculate formulæ of interpolation with one term more; but in this latter case, it will be better to seek for a form of interpolation which applies more exactly to the nature of the phenomenon than the parabolic."

"Yet this (the parabolic) method of interpolation suffices, when it is proposed only to calculate the tables of the dilatation of glass, which are necessary for the correction of air thermometers for the dilatation of their envelopes. In this way I have constructed the following table, which applies to the only two kinds of glass which were employed in the construction of my air thermometers, viz: the crystal of Choisy le Roi, and common tube glass."

"The constants of the parabolic formulæ are—

For the crystal, $a=0$. Log: $b=-4{,}1957769$. Log: $c=-8{,}258066$.

" com. glass, $a'=0$. Log: $b'=-5{,}4171928$. Log: $c'=-8{,}1691500$."

Table of the Dilatations of Crystal and Common Glass.

Temperature by Air Thermometer.		Crystal.		Common glass.	
Fah.	Cent. (T)	Dilatation from 0° to T°. (k_T)	Mean coefficient of dilatation from 0° to T°. (k.)	Dilatation from 0° to T°. (k_T)	Mean coefficient of dilatation from 0° to T°. (k)
50°	10°	0·000227	0·0000227	0·0002628	0·00002628
68	20	0·000454	0·0000227	0·0005285	0·00002642
86	30	0 000681	0·0000227	0·0007973	0·00002658
104	40	0·000909	0·0000227	0·0010689	0·00002672
122	50	0·001137	0·0000227	0·0013435	0·00002687
140	60	0·001368	0·0000228	0·0016211	0·00002702
158	70	0·001594	0·0000228	0·0019016	0·00002717
176	80	0·001825	0·0000228	0·0021851	0·00002731
194	90	0·002054	0·0000228	0·0024716	0·00002746
212	100	0·002284	0·0000228	0·0027609	0·00002761
230	110	0·002516	0·0000229	0·0030532	0·00002776
248	120	0 002747	0·0000229	0·0033486	0·00002790
266	130	0·002980	0 0000229	0·0036468	0·00002805
284	140	0·003212	0·0000229	0·0039479	0·00002820
302	150	0·003445	0·0000230	0 0042525	0·00002835
320	160	0 003678	0·0000230	0·0045600	0·00002850
338	170	0·003912	0 0000230	0·0048705	0·00002865
356	180	0·004146	0·0000230	0·0051822	0·00002879
374	190	0·004380	0·0000230	0 0054967	0·00002893
392	200	0 004616	0 0000231	0 0058171	0·00002908
410	210	0·004851	0·0000231	0·0061383	0 00002923
428	220	0·005088	0·0000231	0·0064636	0·00002938
446	230	0·005325	0·0000231	0·0067919	0·00002953
464	240	0·005561	0·0000232	0·0071232	0 00002968
482	250	0 005799	0·0000232	0·0074559	0·00002982
500	260	0·006037	0·0000232	0 0077922	0·00002997
518	270	0·006275	0·0000232	0·0081324	0.00003012
536	280	0·006514	0·0000233	0·0084756	0·00003027
554	290	0 006753	00·000233	0·0088218	0·00003042
572	300	0 006994	0·0000233	0·0091686	0·00003056
590	310	0·007234	0·0000233	0·0095201	0·00003071
608	320	0·007474	0·0000233	0 0098752	0·00003086
626	330	0·007716	0·0000234	0·0102333	0·00003101
644	340	0·007958	0·0000234	0·0105944	0·00003116
662	350	0·008199	0·0000234	0·0109585	0·00003131

"I will terminate this second part of my work by giving a general table, which includes all the results of the comparison of the normal air thermometer, with the different kinds of mercurial thermometers which I have studied. These results are deduced from graphic constructions executed with much care from the immediate data of experiment. The table commences at 100°, which is the last fixed point at which the thermometers necessarily agree. It is, however, probable, that there exists a sensible difference between 0° and 100° in the movements of those different instruments. Certain series of experiments show it clearly; but the differences are so small that it is difficult to determine them with any precision."

Table of the Comparison of Air and Mercurial Thermometers.

Temperatures by the Air Thermometer.		Centigrade Temperatures by the Mercurial Thermometers.			
Fahr.	Cent.	Crystal.	Common glass No. 5.	Green glass No. 10.	Swedish glass No. 11.
212°	100°	100·00°	100·00°	100·00°	100·00°
230	110	110·05	109·98	110·03	110 02
248	120	120·12	119·95	120·08	120·04
266	130	130·20	129·91	130·14	130·07
284	140	140·29	139·85	140·21	140·11
302	150	150·40	149·80	150·30	150·15
320	160	160·52	159·74	160·40	160·20
338	170	170·65	169·68	170·50	170·26
356	180	180·80	179·63	180·60	180·33
374	190	191·01	189·65	190·70	190·41
392	200	201·25	199·70	200·80	200·50
410	210	211·53	209·75	211·00	210·61
428	220	221·82	219·80	221·20	220·75
446	230	232·16	229·85	231·42	230·90
464	240	242·55	239·90	241·60	241·16
482	250	253·00	250·05	251·85	251·44
500	260	263.44	260·20	262·15	
518	270	273·90	270·38	272·50	
536	280	284·48	280·52	282·85	
554	290	295·10	290·80	293·30	
572	300	305·72	301·08		
590	310	316·45	311·45		
608	320	327·25	321·80		
626	330	338·22	332·40		
644	340	349·30	343·00		
662	350	360·50	354·00		

PART THIRD. *On the Measurement of Temperatures by Thermo-electric Currents.*

As the apparatus for developing a thermo-electric current may be made of very small bulk, and as we have the means of indicating currents of this kind of very small intensity, they have been used ever since their first discovery by Séebeck, for the purpose of measuring temperatures, especially within confined spaces. Pouillet has, moreover, utilized the same principle for the measurement of very high temperatures, and has compared his *magnetic pyrometer* with his air pyrometer, (*Elements de Physique, 4me edition, tome II, p.* 684.—*Comptes Rendus de l'Academie des Sciences, tome III, p.* 786.)

The experiments related in this third part of the present memoir, were tried by M. Regnault, for the purpose of ascertaining how far instruments constructed upon this principle, could be relied upon as thermometers, and the conclusion to which he was led was, that no dependence, whatever, could be placed in the accuracy of their indications.

In order to avoid the difficulties arising from the use of the ordinary galvanometer, Pouillet's sine-needle, or the astatic needle, M. Regnault made use of a differential astatic needle, in which the system being first deflected by a current passing through one of its wires, from a couple iron-platina, was brought back by an inverse current from a pair of bismuth-antimony, passed through the other wire. Thus avoiding all errors or uncertainties arising from alteration of the magnetism of the needles, want of delicacy, or of true centering in the supports, or from too great or too small deflection of the needle from its normal position; while he found by experiment, that the electro-motive force of the bismuth-antimony was so much greater than that of the iron-platina, that a difference of temperature of 100° between the extremities of the latter, was compensated by one of 6°·5 in those of the former.

But when his results came to be projected graphically, the great irregularity and want of coincidence of the curves, shewed that no confidence could be placed in their indications. Sometimes these irregularities occurred suddenly in the midst of the experiments; at others, they took place more slowly. Moreover, when, after the experiments had been carried up to a high temperature, the apparatus was suffered to cool, and the observations recommenced without changing any part of the apparatus, the curve given by the second trial, was found to differ materially from that of the first. Many other combinations were tried, but the two above specified were found the best, and from these facts, M. Regnault concludes that, "if the numerous experiments which I have made upon thermo-electric currents, do not decide that these currents cannot hereafter be used for the measurement of temperatures, they shew, at least, that we are yet far from knowing all the circumstances which influence the phenomena, and from being able to fix the conditions under which thermo-electric elements must be established, so that the intensity of these currents may depend only upon the temperature."

M. Regnault attributes these irregularities principally to molecular changes in the metallic elements at the junctions heated.

Independent of their main purpose, these experiments appear to establish two interesting laws of the relation between the temperatures and the electric current established by them, viz:

First. That a difference of 1° between the two junctions of an element bismuth-antimony, produces sensibly the same deviation of the galvanometer, whatever may be the absolute temperatures, so long, at least, as these are comprised between 15° and 33°. (59° and 91°·4 F.)

Secondly. That an increase of 1° in the difference of the temperatures of the two junctions of an element bismuth-antimony, developes an electro-motive force which is less in proportion as the difference of the temperatures is greater.

General Conclusions.

"It results from the observations developed in this memoir, that the air thermometer is the only instrument of measurement which can, with confidence, be applied to the determination of high temperatures: it is the only one which we shall, in future, employ, when the temperatures exceed 100°."

"Our air thermometer will be founded upon the measurement of the changes in elastic force, experienced by the same volume of air when it is carried to different temperatures; the general disposition of the apparatus will be similar to that which we have already described."

"Ordinarily, air thermometers will be filled with dry air of atmospheric pressure, the reservoirs being in melted ice; sometimes, however, the included air will have the elastic force of the atmosphere only at 100°; and in some cases still more rare, this elastic force will differ from that of the atmosphere both at 0° and 100°. These differences, however, will not prevent the thermometers from being comparable, as we have already shown."

It is proper, whenever possible, so to dispose the air thermometer, that the elastic forces at 0° and 100° may be determined by direct experiment. But it will often happen that the direct determination of these two temperatures is impossible—and the starting points of temperature must then be taken by the mercurial thermometer, and the elements of the formulæ deduced by calculation. If the thermometer incloses air having an elastic force of 760 mm. at 0°, it will present at higher temperatures, the following elastic forces:

Table of the Elastic Force of Air at Different Temperatures.

Temperatures.		Elastic force.	Temperatures.		Elastic force.
Fah.	Cent.		Fah.	Cent.	
32°	0°	760 mm.	752°	400°	1856 mm.
212	100	1036	932	500	2126
392	200	1311	1112	600	2394
572	300	1584	1292	700	2661
662	350	1720	1472	800	2925

If the temperature is not raised above 350°, the outward elastic pressure will not be sufficient to produce any permanent alteration of

the form of the envelope. But at higher temperatures, this may be feared, as well on account of the great outward pressure as from the fact of the glass being sensibly softened by the heat. Therefore, to avoid the first difficulty, and partially the second, when the instrument is to be used for the measurement of high temperatures, the air should be introduced with a less elastic force.

When but a single temperature is to be determined, this may be done conveniently by the following arrangement of the apparatus. A globe of glass with a capillary stem, upon the extremity of which is cemented a steel tubulure provided with a stopcock, is arranged in the medium whose temperature is to be measured, so that the mouth of the tubulure just projects from its wall. The stopcock is left open, the apparatus being connected with a drying tube, until the moment when the temperature is to be measured; the stopcock is then closed, the height of the barometer noted, and the tubulure put into connexion with the manometer before described, the joint being made carefully air-tight. When the apparatus has returned to the surrounding temperature, the difference of height in the columns of mercury in the two manometer tubes, gives the means of calculating the temperature. The principal advantage of this method consists in the fact, that whilst the reservoir is hot, the inward and outward pressures upon it are equal, and there will be consequently no disposition towards a change of figure.

This arrangement is also very suitable for an air pyrometer, the glass globe and stem being replaced by similar vessels of platina. To obtain a capillary platina tube, M. Regnault proposes to take a cylinder of platina, to drill a hole of 2 or 3 mm. diameter along its axis, and fill it with lead, or tin, then draw down the cylinder in a wire-drawing machine, when the exterior diameter will decrease more rapidly than the interior. The tin, or lead, is then melted out, and the bore of the tube thoroughly cleansed by an acid. He states that he has, by this process, succeeded in obtaining capillary tubes of copper.

The sensitiveness of this apparatus will be less in proportion as the temperatures are higher, but it will always be sufficient, in consequence of the great precision with which we are able to measure the elastic forces of gas.

The greatest cause of uncertainty arises from the fact that we do not know the law of the dilatation of the envelope at these high temperatures; but the errors from this cause will not be very great. M. Regnault also suggests that when the experiments do not require a very great precision, a thermometer of the vapor of mercury may frequently be used to advantage for high temperatures. Take a vessel of porcelain, or sheet iron, having an opening in its tubulure, which opening may be closed by a sliding plate. Introduce into it some mercury, and over the mercury, a little naptha. Place the vessel in the medium whose temperature is to be measured, the tubulure being open. The vapor of the naptha will expel the air, and thus prevent the oxidation of mercury, which would otherwise take place at high temperatures. The mercury then boiling, its vapor will complete the expulsion of the air, and dilating like a permanent gas, will establish an equilibrium with the external pressure. When the temperature

is to be measured, close the tubulure by the sliding plate, and withdraw the apparatus; when it has cooled to the surrounding temperature, weigh the mercury which has condensed. The density of the vapor of mercury at 0°, and under a pressure of 760 mm., is 6,976, and consequently a litre weighs 9·020 grammes; then admitting for its dilatation the same coefficient as that for atmospheric air, we may determine the temperature of the medium to which it has been exposed.

(To be Continued.)

Experimental Researches on Figures of Equilibrium of a Liquid Mass withdrawn from the Action of Gravity: Second Series. By M. Plateau.*

The theory of capillary action, as established by the labors of Laplace, Poisson, &c., is not limited to the explanation of the cause of the ascension or the depression of liquids in narrow spaces, and the determination of the laws which regulate this phenomenon; it also permits, as is well known, of our arriving at the differential equation which represents the free surface of a liquid, in circumstances where the form of that surface is influenced by molecular attraction, as for example at the summit of the raised or depressed column in a capillary tube, along the sides of a solid body in part immersed, &c. But this equation cannot be integrated but by approximation, so that it is impossible to determine strictly the forms of the surface in question. On the other hand, on account of the preponderating action of gravity, the influence of molecular attraction can only become observable on surfaces, or portions of surfaces, which present but a small extent either in all directions or at least in one direction, such as the surface which terminates a capillary column, that of a liquid drop placed on a solid plane which it cannot moisten, the portion of the surface of a liquid raised along the sides of the vessel which contains it, &c. It would consequently be very difficult to verify by accurate admeasurements this important part of the theory; and it has hitherto remained almost without any other confirmation than that deduced from this simple aspect of the phenomena.

Now it will be remembered that in his preceding memoir (Taylor's Scientific Memoirs, part xiii. p. 16) M. Plateau described a simple process, by means of which he succeeded in completely neutralizing the action of gravity upon a liquid mass of considerable volume, at the same time leaving this mass perfectly free to obey the molecular forces. If, therefore, as in the case of ordinary capillary phenomena, the attraction of a solid system is interposed, the form which the free surface of the mass will assume will be identically the same as if the liquid had been in reality deprived of all gravity. But then the equation relative to the surfaces of equilibrium is reduced to a very simple form, which allows, in several cases, of omitting the integration; and,

* From an abstract by M. Quetelet, published in the *Bulletin de l'Académie Royale de Belgique*. The First Series of these interesting investigations appeared in the 13th part of the Scientific Memoirs.

on the other hand, nothing any longer limits the extent which may be given to surfaces, so that the results of experiment are susceptible of exact admeasurements. We are thus able to submit the theory to numerous and perfect verifications. This is one of the objects which M. Plateau proposed to himself in his researches, starting from the second series now laid before the Academy.

But his ingenious experiments, besides the support they give to the theory of capillary action, have another kind of interest, in so far as they exhibit the curious spectacle of figures of equilibrium suitable to a liquid deprived of gravity; the theoretical and experimental study of these figures forms a second object of research. The equation representing these figures shows at once that the sphere, the plane, and the cylinder, must be found among them; now, the author has shown, in his preceding memoir, that when the liquid mass of his experiments is not adherent to any solid system, it always assumes precisely the spherical form. With respect to plane and cylindrical surfaces, as they are from their nature indefinitely extended, the first in all directions, and the second in the direction of its axis, it is evident that they cannot be assumed by a finite and entirely free mass; but the author obtains portions of them by causing the liquid mass to adhere to suitable solid systems.

The results at which he arrives on this subject lead him to realize polyhedrons entirely liquid, with the exception of their angles, which are formed of thin iron wires. He produces the cylinder by attaching the liquid mass to two rings of iron wire placed parallel one to the other.

The observation of certain peculiar facts relative to these liquid figures leads the author to several important consequences, among which we may mention the indication of a mode of experiment which would perhaps allow of arriving at the determination of a limit above which must be found the length of the radius of sensible activity of molecular attraction.

Lastly, the author deduces from a property of the liquid cylinder the complete theory of the constitution of liquid veins discharged through circular orifices,—a constitution so completely investigated experimentally by Savart, the cause of which, however, has remained without any satisfactory explanation. Although such a vein be formed of a liquid freely submitted to the action of gravity, M. Plateau shows that we may apply to it, somewhat modified, the considerations relative to a liquid upon which this force does not act.

The author announces, in conclusion, that in the following series he shall direct his attention to other figures of equilibrium of revolution than the sphere and the cylinder, and to figures not included in that class for which the equation may be interpreted in a strict manner.

Lond. Phil. Mag.

Description of Mr. Frederick Ransome's *Process for Making Artificial Stone.*

The first meeting of the Session of the Institution of Civil Engineers,

was held on Tuesday evening, January 11th, 1848, when a paper was read, descriptive of Mr. Frederick Ransomé's progress for making Artificial Stone. The *modus operandi* appeared to be very simple. Broken pieces of silica (common flint) being subjected for a time to the action of caustic alkali, boiling under pressure in a close vessel, formed a transparent silicated solution, which was evaporated to a specific gravity of 1600, (distilled water being 1000), and was then intimately mixed with given proportions of well-washed sand, broken granite, or other materials of different degrees of hardness. The paste thus constituted, after being pressed into moulds, from which the most delicate impressions were readily received, was subjected to a red heat, in a stove, or kiln, by which operation the free, or uncombined silica of the raw materials united with the excess of alkali existing in the solution, thus forming a semi-vitreous compound, and rendering the artificial stone perfectly insoluble. This production must evidently be adaptable to a comprehensive range of objects, for decorative art and architectural purposes; busts, vases, flooring tiles, steps, balustrades, mouldings, capitals, shafts, and bases of columns, &c., &c. Even grinding stones and whetstones for scythes have been made; and in fact, from the beauty and variety of the specimens exhibited, there would appear to be a vast field opening for such a production. It was stated to be extensively manufactured at Ipswich, and it was allowed to admit of extensive application, where elaborately carved stone would be too expensive. **Lond. Artizan.**

Experimental Test of the Value of Marine Glue for Ship Building purposes.

The Lords Commissioners of the Admiralty issued instructions in January, 1843, to the master shipwright of Chatham Dockyard, to have the mainmast of the *Curaçoa*, 24, then fitting at that port, joined with marine glue, to test its capabilities for that purpose. The mast was accordingly made of several pieces of timber joined together, under the immediate superintendence of Mr. Jeffrey, and when completed, measured 28 inches in diameter, and 66 feet in length, and, when put up with the topmast, 90 feet 10 inches. The *Curaçoa* was soon after commissioned by Captain Sir Thomas Pasley, Bart., and proceeded to the South American station, and after serving the usual period was ordered home, and recently paid off at Sheerness. The vessel having been dismasted, their Lordships ordered that the mast should be opened, as is usual after four years' service, to ascertain its present condition. The master-shipwright, Mr. Watts, at Sheerness Dockyard, in compliance with their Lordship's order, set eight men to work with sledge hammers and wedges to separate the timbers, but their whole united efforts at one time, failed in separating the joints, and only split the solid timber into large pieces. Mr. Watts then considered it best to have the mast cut into sections about eight feet long, for one piece to be transmitted to each dockyard, to satisfy the master-shipwrights that they were correct in their judgment when they assembled in committee and reported to the Government, that this in-

vention was "one of the most valuable discoveries of modern days for ship-building purposes." On the mast being cut into pieces, it presented a most perfect and sound interior throughout, and the marine glue was as perfectly adhesive as a fortnight after its application. The foremast which was joined in the upper part in the usual manner adopted at the dockyards, was found to be very rotten, the parts where the wet had entered and been retained, yielding to the pressure of the hand like a piece of sponge, and in other places, where dry, crumbled into powder on being pressed. The original cost of a mast of the same dimensions as the mainmast of the *Curaçoa* is upwards of £250; and now that it has been proved by upwards of four years' trial, that "made" masts joined with marine glue are equally serviceable after that period as when first made, the saving to the country would be very great were all the future made mainmasts for vessels and ships in the Royal Navy to be joined with that substance. Lond. Mech. Mag.

Description of Jones's Gas Exhauster, and its Application, as a Substitute for the Fan, for blowing Cupolas, or Smithies.

Jones's Gas exhauster is a machine invented for the purpose of taking the gas from the retorts as fast as it is generated, and forcing it into the gas holders, in order to relieve them of the backward pressure. It has been at work for the last four years in many large manufactories with great success, and it has occurred to me that it might be used with equal advantage as a substitute for the fan in blowing cupolas or smithies.

The machine consists of a spheroidal case flat-sided, into which are fitted two revolvers of a peculiar shape, which turn on separate axes, and are so fixed in relation to each other, that in every part of their revolution there must be a complete separation between the air on one side of them and that on the other. Motion is given to these revolvers by means of a pulley upon the axis of the lower one; on the other end of which axis is a toothed wheel, working in another toothed wheel of equal number on the end of the axis of the revolver, thus causing them to work in perfect uniformity. The action of the apparatus is precisely that of two pistons working within two chambers alternately opening and closing, and delivering at each revolution a quantity of air equal to the contents of each chamber. As there are no data of the quantity of air a fan of a given size will discharge, I cannot compare the efficacy of the exhauster with it; but when I see the best constructed fan, at its greatest velocity, will only contain a density of air equal to a column of water of 10 in., or a pressure of about 15 oz. on the square inch, and that the exhauster will maintain a density of 50 in., or about 75 oz., on the square inch, and that with a comparative small amount of power, I am led to believe that some advantage exists in the exhauster over the fan.

In an experiment I recently made with an exhauster, 2 ft. by 1 ft. 6 in., and 1 ft thick, I found I could discharge 30,000 cubic feet of air per hour, with a constant resistance of 15 oz. on the square inch. This

(according to the theory of re-smelting iron in a cupola which allows 36,000 cubic feet, or, 2700 lbs. of air to one ton) would be nearly equal to 1 ton of iron per hour, and with an expenditure of not more than 2 horse power. This quantity, of course, could be considerably increased by using a larger sized exhauster.

Mr. Clift observed that it was a spheroidal figure, in which curved figures were revolving in different directions, and the air being admitted, was thrown into the receiving chamber at every revolution. Each revolution throws out a portion of air equal to the chamber.

Mr. Buckle affirmed that the revolver would not answer if driven with spur wheels, as the rate of velocity required to produce any great amount of pressure and quantity for cupolas or smelting purposes, would endanger the safety of the wheels.

Mr. Clift replied, that Messrs. Elkington, Mason, & Co., of Birmingham, had been in the habit of using a fan for the blowing purposes in their manufactory, but had lately removed it, and substituted Jones's exhauster in its place; and they had found it to answer their purpose much better, as they had a greater density than formerly. He also stated that a larger one was in course of erection, and after it had been tried he would report to the Institution the result.—*Proc. Insti. Mech. Engineers.* Artizan, Jan., 1848.

Lecture on the Electricity of Mineral Veins. By Mr. Robert Hunt, *at the Royal Institute.*

Mr. Hunt commenced his lecture by remarking, that the class of phenomena which would form the subject of consideration that evening, although of the highest interest, had not yet received so great an amount of experimental examination as their importance required; and, as their curious nature was, consequently, not generally known, he trusted that, having spent many days and nights in the mines of Cornwall, in this investigation, he should be able to interest his audience by a narrative of the facts now known, as well as some of a novel character.

As a preliminary of absolute necessity, the lecturer explained the nature of a mineral lode by the aid of a beautiful isometrical drawing of the lead district of Nentsford. A lode was, in fact, a fissure, formed by some disturbance of the earth, and filled with mineral deposits. Three theories prevailed as to the origin of mineral lodes; in the first place, they were supposed to be contemporaneous with the rocks themselves; secondly, it was conceived, that fissures were filled by the sublimation of matter from great depths in the earth; and, lastly, that substances were precipitated from solution in water, which flowed through those great rents in the earth. A mineral lode was not to be regarded as being entirely composed of metallic substances; on the contrary, they were most frequently found containing a large portion of earthy matter, amongst which the metallic ore was disseminated. Among the indications which appeared to support the theory of electrical action in these formations, was to be regarded the regular disposition of these substances on either side of the lode. The electrical theory might

be explained in a few words. Ampere supposed that currents of electricity traversed the earth from east to west, and these currents were thought to influence the chemical changes which had gone on within the fissure during the formation of the lode, and determine the order of arrangement. The most striking conditions which appeared favorble to such a view were, that metals of various kinds were found associated with peculiar classes of rocks—tin and copper being associated, in a remarkable manner, with the primary rocks; whilst lead was found more abundantly in the limestone formations. These rules, although general, were not constant—many striking exceptions might be named. In the remarkable mining county of Cornwall the rocks were granite, killas, or clay-slate, greenstone, and elvan. The mineral lodes were always most abundant near the junction of the slate and granite rocks; they were generally found in a direction nearly from north-east to south-west; and where they were contrary to this, or nearly in the line of the magnetic meridian, there was almost invariably a great difference in the character of the mineral substances contained in the lode. This was shown by reference to a very large map of Cornwall, upon which the lodes of lead and copper were accurately marked. Again, a very remarkable parallelism was observed in most districts between the directions of the lodes, and the veins of granitic porphyry (elvan) which occurred in the vincinity; and this fact had been brought in support of the theory, which refers mineral formations to the action of subterranean heat.

The various questions which arose out of the phenomena of mineral veins, and their including rocks, had been most ably treated of by Sir Henry De la Beche, Mr. Joseph Carne, Mr. R. W. Fox, Mr. John Taylor, Mr. Hopkins, and others; he would not, therefore, dwell on that part of the subject.

The lecturer then proceeded to examine, whether any of the conditions known to belong to the rock formations of a mining district were sufficient to produce electrical phenomena. It had been ascertained that granite was always colder than slate—a difference of 2° or 3° was always detected at all depths. This difference might possibly give rise to weak thermo-electric currents; but in the experiments he (the lecturer) had made, to ascertain this point, no such currents had been detected. It was also well known that a constantly increasing temperature was discovered as we descended into the earth. By this means, it was evident that any given portion would represent a bar unequally heated. The following table of temperatures, obtained in the rock and lode, exhibited the variations of temperature in the deep mine of Tresavean:—

At sea level, ...	In granite, . . .	57° F.
At 170 fms., ...	Lode in slate, . . .	77° F.
At 196 fms., ...	Do. in granite, . . .	83° F.
At 208 fms., ...	Do. in granite, . . .	85° F.
At 310 fms., ...	In granite, . . .	94° F.

According to the generally received views of thermo-electric action, such differences would be sufficient to produce currents. That was

undoubtedly the case in metallic and good conducting bodies, but no such result had been obtained from experiments on granite, slate, or greenstone.

[A series of experiments were here introduced—and, notwithstanding the use of an active galvanic series, it was shown that the voltaic current would not traverse either granite, slate, elvan, or greenstone—connexion being made with them and a very delicate galvanometer, upon which, not the slightest indication of any action on the needles could be observed.]

When moist, these rocks became over their surfaces conductors; and, by this means, the action on a single pair of zinc and copper plates, not more than an inch square, was detected through a considerable extent of country. Mr. W. J. Henwood had supposed that he had detected currents of voltaic electricity through the granite and slate rocks of Cornwall; but the lecturer, who had repeated those experiments with great care, was led to believe that the slight deflection of the needle obtained, was due entirely to some chemical action in the wires employed at the point of contact with the rock, or within its length—such slight disturbances being of constant occurrence in all experiments of this class. Although there was not, therefore, any experimental evidence in proof of the voltaic condition of the rocks, yet the regularity of arrangement observed in the lodes themselves—in which zinc, copper, and quartz, lime, pyrites, barytes, fluor-spar, argentiferous lead, and quartz, alternated in the most regular order, as was shown by specimens from the mines of Cornwall, Derbyshire, Saxony, and Mexico—present features so analogous to those which often appear in galvanic experiments, that we are compelled certainly to infer that some modification of the electric force was concerned in the phenomena. Specimens of pseudomorphous bodies from the Cornish mines, and arrangements of brown spar upon quartz, from Schemnitz, quartz upon fluor spar, and iron pyrites, and the double sulphuret of copper upon large quartz crystals, in all of which a uniform system of arrangement, perfectly independent of each other, was shown—and these were to be referred, in all probability, to the disposing power of electrical currents.

Such were the principal evidences to be adduced in support of the electrical theory. Mr. R. W. Fox was the first to discover any indications of electricity in mineral lodes. By placing copper wires against two portions of a lode, or of two lodes divided by a cross-course, and connecting those wires with a galvanometer, a considerable deflection of the needle was obtained—often to such an extent, that, from the violence of the action, it was impossible to note the deflection. In nearly all the mineral lodes of Cornwall, upon which experiments were made, these currents had been detected. Experiments made by Mr. Fox, in Coldberry and Skeers, in Teesdale, gave, however, negative results; and the results on the lead lodes at the Mold Mines were not very decided. Prof. Reich, of Freyburg, obtained very decided results upon the lead and silver lodes of that district; and, in one case, succeeded in detecting a mass of silver ore at some distance behind the rock. Von Strombeck, on the contrary, could obtain no results from

the lead and copper lodes on the right bank of the Rhine. In addition to these results, others of a most satisfactory kind had been obtained by Mr. Henwood and Mr. John Arthur Phillips. The lecturer had, himself, almost invariably obtained very decided galvanometric indications from the copper lodes of Dolcoath, East Wheal Crofty, East Pool, and other Cornish mines—in one instance so powerfully, that electro-chemical decomposition was produced. Mr. Fox has been successful in procuring an electrotype copy of an engraved plate by the current collected from two lodes of iron and of copper pyrites, and also in inducing magnetism in a bar of soft iron. Mr. Pattinson, at the wish of the British Association, made a series of experiments on the rocks of the limestone formation in the lead districts of the north; but he could not detect any evidence of electrical currents.

It now became a question, to ascertain if these currents of electricity, detected in mineral lodes, were in any way connected with the general currents traversing the earth, according to the theory of Ampere; or, were they of a more local character? The lecturer was induced to conclude, from all his experiments and observations, that these currents were entirely local, and due to the chemical action going on within the lode itself. In all cases where chemical action could be detected, it was certain the current acting on the galvanometer, was more energetic than where no chemical change was apparent. In this way might be accounted for the failure of Von Strombeck on the lead and copper lodes of the Rhine, and of Mr. R. W. Fox himself on the lodes of Teesdale—in all probability, those lodes being in a very permanent condition. It was thought by the lecturer that the fact, that these currents often being found to traverse the lodes in a direction contrary to the currents of Ampere, and frequently at right angles to them, militated against that view which referred the one to the influence of the other. The lecturer had also detected currents from piles of ore on the surface, which had been exposed to the influences of the atmosphere; and these currents were certainly only measurers of the amount of chemical action going on in the pile.

That these local lode currents might have a powerful effect upon masses of matter exposed to their influence, was highly probable; and he was disposed to refer the conditions in which cobalt and nickel were often found in the cross-courses, between the ends of dislocated lodes, as due to this local chemical electricity. The character of many of the decomposing lodes was next described; and it was shown that, under the influence of the percolation of rain-water from the surface, charged with oxygen, and the action of the saline water rising from below, few lodes admitting water to flow through them, could be free from chemical action. He had analysed the waters of many of the deep mines, and the following were the results of a few of these analyses:—

The water from Great St. George contained, in a cubic foot, 590 grains of common salt; that of the United Mines, rising hot, 481 grs.; of Dolcoath, 218 grs.; of Great Wheal Charles, 612 grs.; Consolidated Mines, at 80 fathoms, 656 grs., and at the 250 fathom level, 918 grs. This muriate of soda was estimated quite independently of the earthy and mineral salts. It was, doubtless, derived by infiltration from the

ocean; and, from its quantity, acted, no doubt, powerfully upon the lodes it traversed.

Although these currents, detected by the galvanometer, were not regarded by the lecturer as in any way proving electrical agency in the formation of mineral veins, yet the evidence obtained by Mr. Fox, by Mr. Jordan, and more recently by himself, that electricity would give to clay a schistose structure and form along a curved line, no doubt related to some line of electrical action—a miniature lode of copper (of which illustrations were exhibited) supported the general view of electrical action. Incidentally, the conducting powers of iron and copper pyrites, galena, and some other minerals, were experimentally shown; and also the decomposition of yellow ore by electrical action.

In conclusion, the lecturer carefully recapitulated all the main points of evidence, for and against the electrical views, and pointed out many very curious circumstances, evidently dependent upon some peculiar conditions of the adjacent rocks, but which could not be referred, with any certainty, to electrical action. Probably, those currents, which now nearly determined, as in constant flow around the earth, might produce the curious results observed; but a far larger amount of experimental evidence than that yet obtained was required, before this view could be admitted as one of the received facts of inductive science

Lond. Min. Jour.

Description of a New Lever Vise, patented in December, 1843. *By* Mr. J. Peck, *and* Mr. L. Pardee, *of New Haven.*

The accompanying cut and description will explain the principle; it is made entirely of wrought iron, and possesses all the necessary qualities wanted by machinists, cutlers, smiths, and all others who use vises of any kind.

The following qualities, it is claimed, give it a decided superiority to all other vises:—

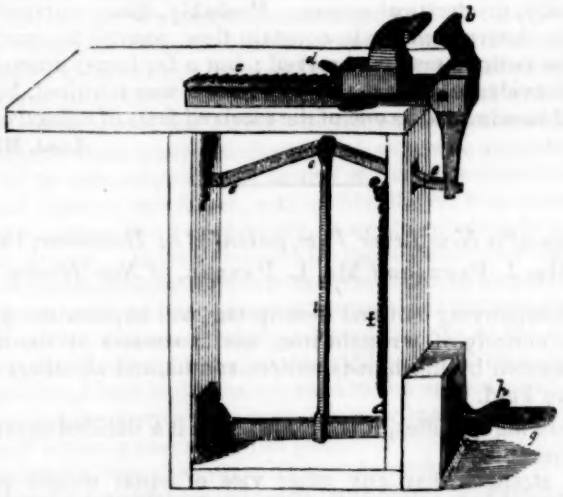
Greater strength than any other vise of equal weight possesses. Greater power, and so applied as to save, in work requiring frequent changes, at least one hour in ten, as it is worked entirely by the foot, without the necessity of laying down a file, or other tool, or without any use of the hand, whatever. It can be changed to receive work from one-sixteenth of an inch, to eight or ten inches in width, as easily and as quickly as any other vise can be moved one-fourth of an inch. And heavy work, requiring both hands to lift, can be easily placed in the vise, without calling the assistance of a second man; it will soon pay for itself in saving of time. It is much easier for the laborer, the strain upon the breast in turning up a screw is entirely avoided, and the vise can be closely approached without being obliged to bend the body over the end of the screw, as in other vises.

When the vise is forced up, it becomes more firmly attached to the bench than any other vise can be, rendering the whole much more solid, which in chipping, and other heavy work, is very desirable.

These vises have been used nearly a year in some of the principal machine shops in the country, and prove all that is claimed for them.

The subscriber has made arrangements for manufacturing these vises, and from the encouragement already received, is induced to believe that the demand for them will be very large, he intends to be supplied with them of all sizes, and will endeavor to be able to fill all orders at short notice. As they are made wholly of wrought iron, the cost will exceed that of cast vises; they may also cost something more than the wrought English vise, but I am assured by an extensive machinist, who has put them to a very severe test, that he finds one of these vises of fifty pounds weight possesses as much strength as the best English vise of seventy pounds. They are offered to the public with a conviction, strengthened by the experience of some of the best mechanics in the country, that they will prove, strength and durability considered, the cheapest, as they are by far the best vise in use.

J. S. Griffing.



a, sliding jaw. *b*, jointed, or swinging jaw. *c*, rail on which the sliding jaw moves. *d*, click which catches in rachet on rail *c*, and holds the sliding jaw firmly where placed. *e*, jointed lever, (elbow joint,) which turns on pins *e e*, and is attached to prong of rail *c*, and the lower end of the swinging jaw. *g*, foot lever with joint attached to leg of bench, and connected by rod *i* with jointed lever. *h*, click which catches in rachet at the foot of the forward bench leg, and holds the jaws firmly as forced up by the combined levers; it is easily tripped with the foot. *f* is a spiral spring which lifts the foot lever, and throws open the jaw.

Briet's Apparatus for Making Mineral Waters.

Translated for the Journal of the Franklin Institute.

This apparatus has already been favorably reported on by the Society for the encouragement of National Industry, and by the Royal

Academy of Medicine. And as it presents a simple and easily manageable form of apparatus, which may be useful or convenient to our readers under certain circumstances, we take the description of the most recently improved form from the Journal de Pharmacie et de Chimie, for January, 1848.

1 2 3 4 5

Two vessels of different capacity, represented by figs. 3, and 4, capable of being screwed together, with a metallic tube represented in fig. 2, compose the apparatus. The vessel 3 is intended to receive the mixture which produces the gas; the vessel 4 is the reservoir in which the liquid is impregnated with it. The apparatus is unscrewed and the vessel 3 placed in the position of the figure; then, by means of a small metal funnel shown above it, 18 grammes (278 grains) of tartaric acid, and 21 grms. (324 grains) of bicarbonate of soda, both reduced to powder, are successively introduced. The metallic stem, fig. 2, is then put in. It consists of a hollow metallic stopper, fitting the mouth of No. 3, and surmounted by a hollow tube, divided throughout its whole length into two compartments, by a longitudinal metallic partition. In the lower part of the stopper is a hollow space, widely open upon the sides, and containing a small ball of glass. In the position in which the tube is placed upon the vessel 3, the ball leaves the opening of the stopper free; but when the apparatus is reversed, the ball closes this opening.

The vessel 4 is then filled with cool water up to the neck. Then the vessel 3 with its metal tube, is turned upside down, and screwed upon No. 4, as is shown, fig. 5. The glass ball then closes the opening of the tube, so that the acid and salt cannot enter the lower vessel. The whole apparatus is then inverted so as to take the position fig. 1. Then by one of the compartments of the tube, the water of the carafe descends into the lower vessel, and continues to descend until it reaches the level of the upper edge of the tube, while the air in the lower vessel ascends by the other compartment to take its place. The descending water dissolves gradually the tartaric acid and carbonate of soda, and carbonic acid is disengaged, which rises into the upper vessel, and under the pressure which it exerts, is dissolved in the water therein contained. The apparatus is shaken from time to time, to facilitate the solution of the gas.

When cool water is used, the operation is finished in less than ten minutes, and the water may be withdrawn as it is wanted, by a screw stopcock. The water which remains, keeps perfectly well.

M. Bussy, who has examined and reported upon this apparatus, and

M. E. Soubeiran, from whom we take the above description, say that the water made in this way is of excellent quality. The apparatus will serve equally well for the preparation of effervescing lemonades, or wines, or mineral waters charged with different salts, by replacing the water of the carafe by the appropriate liquid. The apparatus is made of very thick glass, and each piece is submitted, before sale, to the test of a very strong pressure; for greater security, the two vessels are covered with plaited reeds, which, in case of fracture, prevent the glass from flying. This effect has been proved by actual experiment.

Soubeiran's Recipe for Indelible Ink.

Translated for the Journal of the Franklin Institute.

Crystallized nitrate of silver,	8	parts by weight.
" " of copper,	3	"
" carbonate of soda,	4	"
" aqua ammoniæ,	100	"

Dissolve and keep in a well-corked bottle.

This ink is, of course, to be used without any preparatory liquid. But as the editor of the Journal de Pharmacie justly remarks, requires a certain quantity of gum (say—gum-Arabic pulverized, 50 parts,) to allow it to be used as an ink.—*Journal de Pharmacie et de Chimie, February*, 1848.

Test for Organic Matter in Solution in Abnormal Quantities in Water.

Translated for the Journal of the Franklin Institute.

M. Alph. Dupasquier proposes the chloride of gold for the purpose of detecting organic matter when present in water in such large proportions as to make it unhealthy to drink, or improper for use in the arts.

Into a small glass vessel he introduces from 20 to 25 grammes, (300 or 400 grains,) of the water to be tested, and adds a few drops of a solution of chloride of gold, (carefully freed from excess of acid,) so as to give it a slight yellowish tint: the liquid is then boiled. If the water contains only the quantity of organic matters common to drinkable waters, it retains its color, even after long boiling. But if, on the contrary, it contains an abnormal quantity, it first turns brown, then takes a violet, or blush tint, which indicates the decomposition of the gold salt by the organic matter. By prolonging the ebullition, the violet, or bluish tint becomes deeper and deeper, if the proportion of organic matter is considerable. But a slight brownish, or greenish tint, is sufficient to indicate certainly, that the quantity of organic matter is greater than usual.

The salt must be used without excess of hydrochloric acid which interferes with the reaction.

Very often, during a somewhat prolonged ebullition of the liquid, the

oxide of gold precipitates, owing to the reaction of the carbonate of lime upon this salt; then if the chloride of gold is not in excess, the liquid is decolorised; or if in excess, the shade of color may be changed by a slight cloud which appears. To distinguish this reaction from the former, it is only necessary to add one or two drops of pure hydrochloric acid, which will immediately dissolve oxide of gold, and the color is restored. But when the gold has once been brought to the metallic state by the organic matter, it is not re-dissolved by the hydrochloric acid, and the liquid remains violet, bluish, brownish, or greenish violet, when there has been a tolerably great excess of chloride of gold. If, however, the liquid contains a trace of a nitrate, if it be re-boiled, the gold may re-dissolve.—*Journal de Pharmacie et de Chimie, March*, 1848.

A Liquid for Cleaning Metals.

Translated for the Journal of the Franklin Institute.

"One of the first operations in finishing metallic work after it comes from the casting, or from the hammer, is to free it from the coat of oxide which adheres to it: this is done, generally, by keeping it for some time in water, strongly acidulated with sulphuric, or muriatic acid. But an inconvenience in this process arises from the fact, that the metal is liable to be attacked on its lines and angles, and wherever it presents a point or edge. Hence arises a double loss, both of the acid employed and of the metal.

MM. Thomas, and Dellisse, state that they have succeeded in avoiding these inconveniences, by combining with the acid of the bath, certain organic matters which have the property of preventing, or at least of considerably diminishing, the attacking of the metal by the acids. According to them, glycerine, artificial tannin, napthaline, and kreosote, attain this end. In the baths thus composed, the scale of oxide detaches itself without dissolving, and without the metal being attacked, so that the pieces may remain in the bath as long as may be desired, without alteration.

These facts announced by MM. Thomas, and Dellisse, are corroborated by the experiments of M. Flachat, chief engineer of the Versailles and Saint Germain railroad. M. Mertian, proprietor and director of the forges of Montataire, and M. S. Falatieu, forge master at Bains, testify that they have tried this process upon sheet-iron, and have adopted it to the exclusion of all others. The economy of this process, compared with the former ones, is about two-thirds of the acid employed, and 50 pr. ct. of the loss of metal in cleaning."—*Bull. Soc. Enc. Indus. Nat., January*, 1848, *p.* 51.

Process for Gilding the Wheels of Watches and Chronometers. Submitted by M. PLANTAMOUR, *to the Academy of Sciences, Paris, at a late Sitting.*

The desire for improvements in the construction of time-keepers,

with the view of obtaining the greatest correctness, combined with elegance, has led to the practice of gilding the wheels. Gilding by mercury is impracticable, as it requires an amalgam surface, produced by an acid solution of mercury in aquafortis; the application of which would completely destroy the steel pinions.

The present process obviates this: it consists in using for the amalgamation, a solution of mercury, which will not effect the steel, either in a cold or warm state. To prepare this liquor, a small quantity of mercury is dissolved in a quantity of nitric acid, sufficient for this latter to be in excess; the solution is afterwards saturated by ammonia, and the precipitate is then re-dissolved in an excess of the alkali.

To operate upon the wheels with this solution, no great precaution is necessary; they may be immersed entirely in it, and left there for several minutes, without the pinions being in the slightest degree injured. The ammonia in excess rapidly cleanses that part of the wheel which is to be gilt, and the surface becomes very speedily amalgamed.

In order to apply the gold, the wheels must be withdrawn from the mercurial solution, and the amalgam of gold is laid on without the necessity of wiping them. This being done, they are heated upon a small cylinder, or drum, made of sheet-iron, a spirit lamp being applied underneath. The upper surface of the cylinder has a hole made through it, to admit the pinion, and allow the gilt part of the wheel to be heated, without heating the pinion to an extent which would affect its temper. By means of a coarse brush, the grained, or deadened appearance, usual in the works of watches, is produced; and after cleansing with a scratching brush, and soap and water, the wheel will be gilt and finished; the pinion remaining as bright as it was before the operation.

By means of this process, chronometers, intended for long voyages, may be protected from the influence of the sea air, which often deposits saline particles.—*Bulletin de la Société d'Encouragement.*

Lond. Journ. Arts, & Sci.

On the Advantage of Electrotyping Daguerreotype Plates. By William E. Kilburn.

The following simple experiment, demonstrating the advantages of electrotyping Daguerreotype plates, may be interesting to many of our readers, but more especially to amateurs in that beautiful art.

Purity of silver for the plates has always been much insisted on; and of the various means that have been resorted to to obtain this, the battery process offers the most simple as well as the most satisfactory means of accomplishing it.

Prepare a plate for silvering; but in the place of depositing electrotype silver over the whole face of the plate, only permit the deposit to take place over one-half, by immersing the plate only half way in the decomposition trough. [With a one quart Smee's battery, one minute will be sufficient.] Finish the plate afterwards on removing it from the battery in the usual way, as when preparing it to receive the sen

sitive coating; and when "cross buffed," it will be perceived, on examing the surface, how much *blacker* and more brilliant is the polish on the electrotyped silver half, the remaining half appearing by contrast, quite greasy. The importance of this depth of black will at once be appreciated, when it is remembered that it is the black burnish of the silver which forms the dark portions or blacks of the Daguerreotype picture. If the plate thus prepared, be now made sensitive and placed in the camera, it will be found that the electrotype half has also an advantage in sensitiveness, the "halved image" being about four seconds, or about one-third of the exposure in advance of the other side not coated in the battery. I have tried this with a great variety of solutions, and always with the same result.

Lond. Edin. & Dub. Phil. Mag.

On the Separation of Sulphur from Ores. By Mr. John Howson.

Sir,—In the paper of M. Sinding's, on mundic and its uses, which appeared in the last number of the *Mining Journal*, is a powerful confirmation of the ease with which steam effects the separation of sulphur from minerals. The frequent recourse which has been had to sublimation, the varied success that has attended its application, and the low produce thereby obtainable, prove, incontestibly, that it is not adapted for the production of large quantities of sulphur at a cheap rate; while the trials of M. Sinding, though undertaken with the view of improving the sublimatory process, point to steam as the only agent by which it can be permanently established. Throughout his experiments, the moisture frrom the fuel and the furnace, being converted into steam, and carried, with the vapors of combustion, over the heated ore, decomposed it, with the production of oxide of iron and sulphuretted hydrogen gas, in such abundance as to render the presence of the latter very objectionable. This gas exhibited itself contemporaneously with the sublimation of the sulphur—clearly evidencing, that the heat necessary to its production, is not greater than that required to drive the sulphur from the ore; and, while the greatest amount, capable of being obtained by this process, is not more than 16 or 17 per cent., decomposition by steam would give the whole, or 53 per cent., leaving the ore in a better condition, and free the sub-sulphate, which usually attends the common calcining methods. The plan employed to bring the sulphur, in the sulphuretted hydrogen, again into the solid form, is a simple and natural operation; merely requiring, that the admission of air to the furnace should be so regulated, as to convert one-third of it into sulphurous acid gas; which, by combining with the remainder, would cause mutual decomposition to take place, and the sulphur from both gases to be deposited. Had advantage been taken, by M. Sinding, of this plan, and a due supply of air admitted to the sulphuretted hydrogen formed, the inconvenience arising from this gas, would have been overcome, and the per centage of sulphur necessarily augmented.

The immense quantities of sulphur which are annually wasted at the various metallurgic establishments of this country, and the exten-

sive deterioration of atmosphere consequent thereon, and the practice of resorting to foreign countries for our supply, when such vast beds of ore, capable of yielding it at a cheaper rate, remain untouched, is a disgrace to a commercial community. Lond. Min. Journ.

Linen Fired by Solar Heat.

In the case of a fire which occured on Monday week, in a warehouse at St. Paul's Churchyard, Mr. Braidwood reports to the insurance offices that the cause of it was the firing of a linen curtain first at the open part of a window. It seems doubtful, however, whether by "the open part" of the window he means that the sash was open, or merely that the fire originated by the solar action through the glass where exposed openly to the solar ray. The heat was lately, it is said, 21 degrees above the average of the same time of the year for twenty-five years past; but the firing of linen by the unconcentrated rays of an English sun in May, would be a phenomenon likely to startle the linen-clad denizens of the tropical south. Lond. Builder.

FRANKLIN INSTITUTE.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on the Explosion of a Stationary Engine.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, by whom was appointed a sub-committee to examine into the cause of the explosion of a stationary engine in Maiden Street, Philadelphia, on the 2nd day of May, 1848,

Report, That the boiler consisted of two concentric cylinders, placed with their axis vertical. The outer one was 10 feet long, and 4 feet in diameter; the inner one was 8 feet long, and 3 feet 7½ inches in diameter. They were made of ¼ inch boiler iron, and were connected together at their lower edges. About 2 feet below the top of the outer cylinder, the inner one was closed by a stout circular head of boiler iron, ½ inch in thickness, which was connected with the head of the outer cylinder by four double wrought-iron stay-bolts. Through this lower head passed 78 wrought-iron tubes about 6½ feet long, of which 48 had an internal diameter of 2 inches each, and 30, of 1¼ inches, arranged in concentric circles, around a large central tube of the same length, 7½ inches in internal diameter. They were all closed at their lower ends. These tubes were firmly secured into the head of the inner cylinder at their upper ends, and were suspended from it in the furnace. The furnace consisted of the space inside of the inner cylinder, the lower edge of the fire-door being on the level of the junction of the two cylinders, and the flue or smoke pipe entering just below the lower head or tube-sheet. It will be seen that the water or steam space consisted of the upper part, about two feet in length of the outer cylinder, the space between the two cylinders,

and the inside of the tubes. There were no stays connecting the two cylinders, except those which have been already mentioned as passing between the two heads. The furnace was interior, and the whole of the surface exposed to the action of heat, with the exception of the areas of the bottoms of the tubes, and the tube sheet which was far removed from the fire, was arranged vertically. The feed water was introduced into the space between the two cylinders about 3 inches above their lower junction, and upon the right side of the fire door. There were three gauge cocks in the upper part of the boiler, the lower one of which was disused, having become obstructed; the second was 8 inches above the tube sheet, and the third 7 inches above that. This boiler was usually connected with another horizontal boiler, 13 feet by 3½, consisting of two concentric cylinders, with 10 crossing water tubes, 7 inches in internal diameter. The water spaces of the two boilers were connected below, and a pipe passed from the upper part of the horizontal, into the steam space of the vertical boiler. This boiler was however not in use at the time of the accident.

The boiler was thrown nearly vertically upwards, passing through the upper stories of the building, upon the ground floor of which it was placed, and after having risen, according to the evidence of eye-witnesses, to a very great height in the air, fell in the street at a distance of about 70 feet from its point of departure.

Upon examining the boiler, the committee found that the inner cylinder had given way near the bottom. The rivets between the lowest and second sheets had been shorn off, and the line of separation was continued on one side by the tearing of the iron, so as to pass about half way around the boiler, and at each end of the fracture there was a short tear in a vertical direction. The inner cylinder had been forced in upon the tubes, which were displaced and crowded together, and was folded as shown in the accompanying diagram which represents the appearance of a cross section made just above the top of the fire door. The centre of this line of fracture was diametrically opposite to the feed pipe. This yielding of the inner cylinder was less towards the tube sheet, above which the boiler was apparently totally uninjured. It was sufficiently evident then that the boiler had yielded to a strong pressure exerted between the two cylinders, which had forced the inner one, which presented the least resistance, inwards, shearing the rivets by the lateral motion of the boiler plates, and completing the opening for the escape of steam, by tearing the iron itself. The committee had two pieces of the iron cut along the edges of the fracture, one in the direction of the rolling of the iron, the other at right angles to this direction. These pieces being reduced by filing to a proper cross-section, were placed in the breaking machine of the Institute, for the purpose of testing their tensile strength. The piece cut in the direction of the grain of the iron broke in the part where it was grasped by the wedges, with a strain of 58,080 lbs. per square inch. As the wedges had marked the surface very deeply, this experiment can only suffice to give the lower limit of its tensile strength, and the committee regret that they could not procure another piece of the iron for the purpose of repeat-

ing the experiment. The piece cut across the grain broke with a strain of 60,480 lbs. per square inch. The iron therefore had a strength to resist tearing very considerably above the average of boiler iron. It however presented a very crystalline fracture, and frequently broke short with the blow of the sledge, which may have been the effect of overheating.

The committee noticed no conclusive marks of overheating upon the iron, but there was a triangular space extending from the bottom of the boiler diametrically opposite the point of introduction of the feed water, to the insertion of the smoke flue above, in which the whole of the deposit which thinly coated the rest of the boiler was burned off, and the surface was clear.

The circumstances connected with the explosion as stated by Mr. Miles, the proprietor, were these: The engine was under the charge of a lad who had always shown himself to be careful and attentive. He was in the habit of filling the boiler with cold water until it began to run from the second gauge cock. The power of the engine was rented out to workmen in the building, and was principally used for turning grind-stones. The safety valve was usually loaded to a pressure of 98 lbs. per square inch, (and the measurements which the committee were enabled to make, were confirmatory of this part of Mr. Miles' statement.) The accident happened about half an hour before the usual hour for the assembling of the workmen in the morning. Mr. Miles was in the house; as the steam was got up earlier than was necessary, he directed the lad to open the fire door, and shut off the draught, which was done, and in about three minutes the boiler exploded. It seems therefore that the explosion took place upon the reduction of the temperature of the boiler. The force must have been tremendous, but the destruction of the building by fire, and the usual vagueness and inconsistencies of eye-witnesses to such an event, prevent any even approximate calculation of it.

That the explosion of the boiler was not caused by a gradually accumulating pressure arising from the continual formation of steam under a fastened safety valve, the circumstances of the case show. The accident having occurred before the time for commencing work, every even plausible motive for such conduct is removed, and it could scarcely have taken place accidentally under the heavy pressure necessary to produce the effects exhibited. Besides, the occurrence of the explosion upon the reduction of the heat of the furnace, appears to the committee perfectly conclusive against this supposition.

That the boiler did not explode from carelessness in supplying it with a proper quantity of water, is rendered probable by the testimony that the gauge-cocks had been shortly before tried, and that a large quantity of water was actually discharged from the boiler at the time of the explosion. The character of the boy who had charge of the boiler, for carefulness, joined with the fact that he was under the immediate inspection of his employer, and the total absence of any conceivable motive for wilful negligence in this regard, should suffice to reject this supposition, if it be possible fairly to account for the explosion otherwise, and the committee believe that a mere glance into the arrange-

ment of the boiler will suffice to show the possibility of such an explanation.

In fact, it appears to the committee hardly possible to devise a boiler of a more dangerous construction. Narrow water spaces, most of them tubular, closed below, and presenting the least advantages for the formation of currents, by means of which water might be continually supplied; the inner cylinder presenting a surface of 90 square feet without a single stay, and exposed to a crushing pressure, so that every change of figure diminishes the resistance to the force of the steam. The experience with locomotive engines shows that it is nearly impossible to keep water in the narrow water spaces which surround their fire boxes, and these spaces are therefore carefully stayed, while we have here an immense surface exposed to the same source of danger, without any support from the inner shell. The steam space of the boiler, allowing for this purpose the space above the upper gauge-cock, was much too small for a stationary boiler, and the water space, including the interval between the two cylinders, the tubes, and the space above the tube-sheet as far as the upper gauge cock, was singularly small when compared with the external dimensions and amount of material of the boiler. In fact the whole cubic content of the water room was but 82,535 cubic inches (about 48 cubic feet, or 357 gallons). Nor is the arrangement advisable in an economical point of view, the surface exposed to the action of the fire, and the heated air being almost entirely vertical, would present itself in a disadvantageous position, and the large clear spaces above the fuel, would permit much of the heated air to ascend freely and escape without communicating its heat to the water at all. The boiler therefore could not have been an economical one, and was most undoubtedly in the highest degree unsafe.

The committee believe that the following is the most probable explanation of the catastrophe: The first effect of the heat would be to expel the water from the water space between the two cylinders and from the tubes (except the centre one). This would be easily and efficiently accomplished in consequence of their small diameter, and closed bottoms, with the exception of that part of the water space where the feed was introduced, where there would of course be kept up a continual current of water. The water then being expelled from these spaces, they would soon become very hot, and since, in this condition, the only effective communication between the heat of the fuel and the water above, would be by means of that in the central tube, it would require a considerable time to heat the whole water up to the proper temperature for generating steam of 90 lbs. pressure, and during this time the walls of the empty spaces would become very hot. When the fire door of the furnace was opened, and the draught shut off, the diminution of the heat would soon permit the water to be forced back by the pressure of the steam above it into the spaces before filled with steam only, and this water coming in contact with the highly heated surfaces, would generate suddenly a steam of great pressure which could not be relieved by the safety valve, and since the action would continue, the boiler must give way, which